

135-TRC-19-004

Compliance Testing For FMVSS 135
HYDRAULIC AND ELECTRIC BRAKE SYSTEMS

FCA US LLC
2019 Ram 1500
NHTSA No. C20190303

TRANSPORTATION RESEARCH CENTER INC.
East Liberty, Ohio 43319



August 26, 2019

FINAL REPORT

PREPARED Under Contract No.: DTNH22-16-D-00027:

U.S. DEPARTMENT OF TRANSPORTATION National
Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
1200 New Jersey Avenue S.E.
West Building 4th Floor
OVSC (NEF-210)
Washington, D.C. 20590

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16. ABSTRACT: Compliance tests were conducted on the subject 2019 Ram 1500, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-135-01 for the determination of FMVSS 135 compliance. Test failures identified were as follows: None.			
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1.0 PURPOSE OF COMPLIANCE TEST

Tests were conducted on a 2019 Ram 1500, manufactured by FCA US LLC to determine compliance with FMVSS 135 "Hydraulic Brake Systems."

All tests were conducted in accordance with the U.S. DOT, NHTSA Laboratory Procedure TP- 135-01 and/or the corresponding Transportation Research Center Inc. (TRC Inc.) test procedure, which was submitted to NHTSA for their approval. The test procedure was clearly described in the submitted document and has not been repeated in this report.

All stops were performed manually.

TRC Inc. personnel using the following TRC facilities conducted all tests:

7.5-Mile Test Track Top

Speed

Burnish & Reburnish

Skid Pad

Instrument Check

Effectiveness

Failed Stops Inoperative

Power Assists

Brake Slope

Parking Brake

Average PFC during the test period was 0.96 (Skid Pad) and 0.97 (Test Track) utilizing the ASTM E1337 w/E1336 tire method.

The test vehicle met all the requirements of FMVSS 135.

2.0 SUMMARY OF RESULTS

VEHICLE: 2019 Ram 1500

PROJECT NO.: C20190103

DATE: 08-08-2019

Test	Loading Condition	Specification and Limit				TEST RESULTS (In compliance if one stop meets requirement)			
		Speed (kph)	Min Pedal Force (°C)	Max Pedal Force (°C)	Stopping Distance Reequipment (m)	Shortest Stop Max Pedal Force (Average - °C)	Shortest Stop Stopping Distance (m) (Corrected)	Pass / Fail	
Equipment Requirements						Specified Equipment			
Vehicle Maximum Speed	LLVW	NA						Pass	
Burnish	GVWR	80					80.8	Pass	
Burnish	GVWR	80						Pass	
Wheel Lockup Sequence w/o ABS	GVWR				Lockup of front wheels prior to rear	ABS equipped - not required		N/A	
Wheel Lockup Sequence w/o ABS	LLVW					ABS equipped - not required		N/A	
Adhesion Utilization w/o ABS	LLVW				Rear axle adhesion utilization curve below specified line	ABS equipped - not required		N/A	
Adhesion Utilization w/o ABS	GVWR					ABS equipped - not required		N/A	
Cold Effectiveness	GVWR	100	65	500	70	368 N	48.9 M	Pass	
Cold Effectiveness	GVWR	100	65	500	70				
High Speed Effectiveness	GVWR	138.8	65	500	143	435 N	84.5 M	Pass	
High Speed Effectiveness	GVWR	138.8	65	500	143				
Stops with Engine Off	GVWR	100	65	500	70	414 N	47.6 M	Pass	
Stops with Engine Off	GVWR	100	65	500	70				
Cold Effectiveness	LLVW	100	65	500	70	396 N	45.8 M	Pass	
High Speed Effectiveness	LLVW	138.8	65	500	143	464 N	81.9 M	Pass	
Failed Antilock	LLVW	100	65	500	85	168.3 N	56.6 M	Pass	
Failed Antilock	LLVW	100	65	500	85				
Failed Proportioning Valve	LLVW	100	65	500	110				
Failed Proportioning Valve	LLVW	100	65	500	110				
Failed Hydraulic Circuit #1	LLVW	100	65	500	168	422 N	62.9 M	Pass	
Failed Hydraulic Circuit #1	LLVW	100	65	500	168				
Failed Hydraulic Circuit #2	LLVW	100	65	500	168	124.8 N	125.8 M	Pass	
Failed Hydraulic Circuit #1	GVWR	100	65	500	168	468 N	74.4 M	Pass	
Failed Hydraulic Circuit #2	GVWR	100	65	500	168	483 N	112.6 M	Pass	
Failed Antilock	GVWR	100	65	500	85	179 N	54.2 M	Pass	
Failed Proportioning Valve	GVWR	100	65	500	110				
Regenerative Brake System (RBS) Failure	GVWR	100	65	500	168				
Electromotive Force (EMF) - Battery Failure	GVWR	100	65	500	70				
Power Brake Unit Failure	GVWR	100	65	500	168	196 N	56.3 M	Pass	
Power Brake Unit Failure	GVWR	100	65	500	168				
Parking Brake - Uphill	GVWR	-	-	500	Hold for 5 min ?	38 N	Held	Pass	
Parking Brake - Uphill	GVWR	-	-	500	Hold for 5 min ?				
Parking Brake - Downhill	GVWR	-	-	500	Hold for 5 min ?	42 N	Held	Pass	
Heating Snubs	GVWR	120 - 60	65	500	15 snubs - 3.0 m/s/s			Pass	
Heating Snubs	GVWR	120 - 60	65	500	15 snubs - 3.0 m/s/s				
Hot Performance Stop #1	GVWR	100	65	500	70	161 N	46.4 M	Pass	
Hot Performance Stop #1	GVWR	100	65	500	70				
Hot Performance Stop #2	GVWR	100	65	500	70	164 N	60.2 M	Pass	
Brake Cooling	GVWR	50	NA	NA	4 stops = 3.0 m/s/s	175 N	41.5 M	Pass	
Brake Cooling	GVWR	50	NA	NA	4 stops = 3.0 m/s/s				
Recovery Performance Stop #1	GVWR	100	65	500	one of the two stops between 37.5 and 68.9 meters	161 N	41.3 M	Pass	
Recovery Performance Stop #1	GVWR	100	65	500	one of the two stops between 37.5 and 68.9 meters				
Recovery Performance Stop #2	GVWR	100	65	500				Pass	
Final Inspection-Brake Integrity						264 N	44.6 M	Pass	
Final Inspection-Brake Integrity								Pass	

DATA SHEET 1 VEHICLE INFORMATION

MAKE/MODEL/BODY STYLE:

MODEL YEAR: 2019 ; MANUFACTURE DATE: 05-2018
NHTSA NO.: C20190303 ; VIN: 1C6SRFGT1KN552167
GVWR: 3,221 kg ; WHEELBASE: 380.0 cm
GAWR FRONT: 1,770 kg ; GAWR REAR: 1,860 kg

FOR BUSES ONLY –

CHASSIS MFR.: _____
SERIAL NO.: _____ ; NO. OF SEATS: _____
MANUFACTURE DATE: _____
ENGINE TYPE: V8
ENGINE HORSEPOWER: 395 ; DISPLACEMENT: 5.7 Liter
TRANSMISSION TYPE: Automatic ; IDLE SPEED: 800 rpm
NO. OF AXLES: 2

ELECTRIC VEHICLE: _____ ; HYBRID VEHICLE: _____

TIRE SIZE: 275/65R18 ; TYPE: Radial, Tubeless
TIRE MANUFACTURER: Bridgestone
RECOMMENDED PRESS. AT GVWR: FRONT - 250 kPa ; REAR - 250 kPa

BRAKES - FRONT: DRUM _____ ; DISC X
BRAKES - REAR: DRUM _____ ; DISC X

BRAKE ACTUATION - Describe Hydraulic Circuit Split:

FOUNDATION BRAKES :
HYDRAULIC X ; ELECTRIC _____ ; SPLIT _____

ELECTRICALLY-ACTUATED SERVICE BRAKES: YES NO X

ELECTRIC TRANSMISSION OF SERVICE BRAKE CONTROL SIGNAL: YES NO X

REGENERATIVE BRAKING SYSTEM (RBS): YES NO X

DATA SHEET 1 (CONT)

RBS PART OF SERVICE BRAKE SYSTEM: YES NO N/A

BRAKE POWER UNIT: Hydraulic ; Vacuum ; Other

BRAKE POWER ASSIST UNIT: YES X NO

BRAKE POWER UNIT WITH ACCUMULATOR: NO

BRAKE POWER ASSIST OR POWER UNIT WITH BACKUP: NO

VARIABLE PROPORTIONING SYSTEM: _____ NO _____

ANTISKID DEVICE:MFR- Conti-Tevis DIRECTLY

CONTROLLED WHEELS: Yes, all 4.

PARKING MECHANISM: _____

DESCRIBE Electronic switch engages camper motor to engage park brake.

BRAKE MASTER CYLINDER DIAMETER: 50.8 mm

BRAKE PEDAL RATIO: 2.40:1

FRONT BRAKE COMPONENT MATERIALS AND CONSTRUCTION:

FOR DRUM BRAKES			FOR DISC BRAKES		
MATERIAL	CONSTRUCTION		MATERIAL	CONSTRUCTION	
Cast Iron	Cast	X	Cast Iron		Integral Cast
Steel	Composite		Steel		2-Piece
Bi-Metallic	Centrifused		Bi-Metallic	X	Vented
	Pressed				Unvented

FRONT BRAKE DIAMETER: Inside - 197.55mm ; Outside - 377.97mm

FRONT DISC BRAKE THICKNESS (include vent): 30.20mm

DATA SHEET 1 (CONT)

FRONT DRUM BRAKE SHOE CAGE DIA.: Left - N/A ; Right - N/A
 DIAMETER RESET TO: Left - N/A ; Right - N/A

FRONT BRAKE COMPONENT DIMENSIONS AND LINING CODE/COLOR:

	FOR DRUM BRAKES			FOR DISC BRAKES	
WIDTH	Primary			Inboard	66.38 mm
	Secondary			Outboard	66.39 mm
LENGTH	Primary			Inboard	176.87 mm
	Secondary			Outboard	176.79 mm
THICKNESS	Primary			Inboard	13.53 mm
	Secondary			Outboard	13.33 mm
CODE/COLOR	Primary *			Inboard	FM-FER9213-FH
	Secondary *			Outboard	FM-FER9213-FH

* Primary/Secondary may be leading/trailing or other

HYDRAULIC PISTON DIAMETER:57.02 mm x2 Pistons

DRUM BRAKE WHEEL CYLINDER - _____
 DISC BRAKE CALIPER - X _____

REAR BRAKE COMPONENT MATERIALS AND CONSTRUCTION:

FOR DRUM BRAKES			FOR DISC BRAKES			
MATERIAL	CONSTRUCTION		MATERIAL	CONSTRUCTION		
Cast Iron	Cast	X	Cast Iron	X	Integral Cast	
Steel	Composite		Steel		2-Piece	
Bi-Metallic	Centrifused		Bi-Metallic		Vented	
	Pressed				Unvented	

REAR BRAKE DIAMETER: Inside - 221.52 mm ; Outside 375.01 mm

REAR DISC BRAKE THICKNESS (include vent): 22.08 mm

DATA SHEET 1 (CONT)

REAR DRUM BRAKE SHOE CAGE DIA.: Left - N/A ; Right - N/A
 DIAMETER RESET TO: Left - N/A ; Right - N/A

REAR BRAKE COMPONENT DIMENSIONS AND LINING CODE/COLOR:

	FOR DRUM BRAKES		FOR DISC BRAKES	
WIDTH	Primary		Inboard	50.90mm
	Secondary		Outboard	50.94mm
LENGTH	Primary		Inboard	128.30mm
	Secondary		Outboard	128.27mm
THICKNESS	Primary		Inboard	11.71mm
	Secondary		Outboard	11.38mm
CODE/COLOR	Primary *		Inboard	NAC-N609HFF
	Secondary *		Outboard	NAC-N609HFF

* Primary/Secondary may be leading/trailing or other

HYDRAULIC PISTON DIAMETER: 56.04mm x1 Piston

DRUM BRAKE WHEEL CYLINDER - _____
 DISC BRAKE CALIPER X

OTHER COMPONENT INFORMATION:

Friction-type Parking Brake - X Hand Operated

 Foot Operated

Nonservice Brake Type Parking Brake - Hand Operated

 Foot Operated

ELECTRIC BRAKES INFORMATION: N/A

NOTE (do not include this note in final report): If at any time after the test series has begun, any brake system part requires replacement or the brake system requires adjustments other than permitted in burnish and reburnish procedures, discontinue testing and notify the COTR immediately.

DATA SHEET 3 VEHICLE WEIGHT

VEHICLE: 2019 Ram 1500 ; NHTSA NO.: C20190303 ; DATE: 07-30-2019

TIRE PRESSURE (Cold): Front - 240 kPa Rear - 240 kPa

ODOMETER READING: Start - 88 Finish - 561

SCALE(S) USED: Mettler Toledo

NOTE: GVWR, LLVW and axle weights to measured within + 0% and -1%.

GVWR/GAWR INFORMATION (taken from vehicle Certification Label):

GVWR - 3,221 kg (GAWR Front = 1,770 kg and GAWR Rear = 1,860 kg)

UNLOADED VEHICLE WEIGHT (**UVW**):

Left Front - 718 kg Left Rear - 498 kg

Right Front - 691.6 kg Right Rear - 476.4 kg

Total Front - 1,409.6 kg Total Rear - 974.4 kg

TOTAL UVW - 2,384 kg

Front Axle Load % = Total Front / TOTAL UVW = 59.1 %

Rear Axle Load % = Total Rear / TOTAL UVW = 40.9 %

LIGHT LOADED VEHICLE WEIGHT (**LLVW**):

Note 1: LLVW = UVW + 400 lb (181 kg)

Note 2: Weight distributed in front passenger seat area

Note 3: Neither axle load at LLVW less than at UVW; ballast as required

Left Front - 774.6 kg Left Rear - 533 kg

Right Front - 746.8 kg Right Rear - 510.4 kg

(Continued on next page)

DATA SHEET 3 (CONT)

Total Front - 1,521.4 kg

Total Rear - 1,043.4 kg

TOTAL LLVW - 2,564.8 kg

Front Axle Load % = Total Front / TOTAL LLVW = 59.3 %

Rear Axle Load % = Total Rear / TOTAL LLVW = 40.7 %

ACTUAL TEST LLVW:

Left Front - 778 kg

Left Rear - 532.2 kg

Right Front - 744.4 kg

Right Rear - 510.2 kg

Total Front - 1,522.4 kg

Total Rear - 1,042.4 kg

TOTAL ACTUAL TEST LLVW - 2,564.8 kg

Front Axle Load % = Total Front / TOTAL ACTUAL TEST LLVW = 59.3 %

Rear Axle Load % = Total Rear / TOTAL ACTUAL TEST LLVW = 40.7 %

Load: Driver/Observer-90 kg + Instrumentation.-40 kg + Ballast-41 kg = 400 lbs (181kg)

FULLY LOADED VEHICLE WEIGHT (GVWR):

Note 1: Vehicle loaded so axle loads proportional to GAWR shown previously

Note 2: But no axle weight to be less than at LLVW

Note 3: If weight on any axle at LLVW exceeds the axle's proportional share of the GVWR, the load required to reach GVWR is placed so that the weight on that axle remains the same as at LLVW. Neither axle load at LLVW **LESS THAN** at UDW.

Load: Driver/Observer-90 kg + Instrumentation.-40 kg + Ballast-41 kg = 181 kgs

Left Front - 807.4 kg

Left Rear - 830.1 kg

Right Front - 782 kg

Right Rear - 821 kg

Total Front - 1,569.4 kg

Total Rear - 1,651.1 kg

(Continued on next page)

DATA SHEET 3 (CONT)

FULLY LOADED VEHICLE WEIGHT (GVWR) - 3,220.5 kg

Front Axle Load % = Total Front / FULLY LOADED VEH. WT. (GVWR) = 48.7 %

Rear Axle Load % = Total Rear / FULLY LOADED VEH. WT. (GVWR) = 51.3 %

Comments:

TECHNICIAN: Braeden Eirich; QUALITY ASSURANCE: David Karls

APPROVING LAB. OFFICIAL: David Karls DATE: 07-30-2019

INSTRUMENT CALIBRATION (12 MONTH MAXIMUM INTERVAL)

INSTRUMENT	SERIAL NUMBER	CALIBRATION DATE	NEXT CALIBRATION
Data Acquisition System	Link 4000 VMax System	2-20-2019	2-20-2020
Computer	Windows Surface Pro	Per Use	
Software	Rev Data Plus	N/A	
LF Torque Wheel			
Rf Torque Wheel			
LR Torque Wheel			
RR Torque Wheel			
LF slip Ring			
RF Slip Ring			
LR Slip Ring			
RR Slip Ring			
Pedal Force Transducer	GSE 120	Per Use/ 3-18-2019	3-18-2020
Park Brake Force Transducer			
LF Hydraulic Pressure Transducer			
RF Hydraulic Pressure Transducer			
LR Hydraulic Pressure Transducer			
RR Hydraulic Pressure Transducer			
Accelerometer	Setra 1215576	Per Use/ 3-22-2019	3-22-2020
Fifth Wheel			
Wind Velocity	TRC Control Tower	Per Day Use	
Ambient Temperature Gauge			
LF Brake Thermocouple	Omega	Per Use	
RF Brake Thermocouple	Omega	Per Use	
LR Brake Thermocouple	Omega	Per Use	
RR Brake Thermocouple	Omega	Per Use	
Fifth Wheel Velocity	Race Logic GPS	Per Use	
Lock-up Detection System	Servo Tek SA10025SA	Per Use	

QUALITY ASSURANCE: David Karls

DATA SHEET 4
MAXIMUM SPEED

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	7/31/2019
TEMP.:	72°F 78% ^H	WIND VELOCITY:	5mph 242°SW	ROAD PFC:	0.9
ODOMETER START:	89	ODOMETER FINISH:	107		

Test Weight: Total = 2,564.8 kg Front = 1,522.4 kg Rear = 1,042.4 kg

Establish vehicle maximum speed

VEHICLE LOAD: LLVW
 GEAR: Drive
 PEDAL FORCE: Not applicable
 TEST SPEED: Maximum attainable from a standing start in 3.2 km.
 IBT: Not applicable
 DECEL RATE: Not applicable
 WHEEL LOCKUP: Not applicable
 INTERVAL: Not applicable

Ballast Vehicle to LLVW

Accelerate at a maximum rate from a standing start for a distance of 3.2 km on a level surface.

Repeat in opposite direction

Record speed attained in each direction and the average of the two runs.

	DIRECTION	MAX. SPEED (km/h)		Time 0-100 km/h
		Visual	Recorded	
Run No. 1	North	106mph	169.7	6.1
Run No. 2	South	106mph	169.8	6.1

Average = 169.75 km/h

Tested by: Braeden Eirich Date: 8/8/2019

Approved by: David Karls Date: 8/8/2019

DATA SHEET 5
14.1 Burnish (S7.1)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/1/2019
TEMP.:	80°F 65% ^H	WIND VELOCITY:	2mph 209°W	ROAD PFC:	0.9
ODOMETER START:	115	ODOMETER FINISH:	330		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

VEHICLE LOAD: GVWR

GEAR: Drive

PEDAL FORCE Adjust as necessary to maintain constant decel rate.

TEST SPEED: 80 km/h to 0

IBT: ≤ 100°C (Record temperatures .32 km before stop)

DECCEL RATE: 3.0 m/s²

WHEEL LOCKUP: None longer than 0.1 seconds at speeds > 15 km/h.

INTERVAL: The interval from the start of one service brake application to the start of the next is either the time necessary to reduce the IBT to 100°C or less, or the distance of 2km, whichever occurs first.

Comments:

BURNISH

RECORDED DATA

STOP NO.	Initial SPEED (KM/H)	INITIAL BRAKE TEMPERATURE (°C) (Secondary Shoe or Hottest Pad)				MAX. PEDAL FORCE (N)	AVG. PEDAL FORCE (N)	AVERAGE SUSTAINED DECELERATION (m/s ²)	COMMENTS
		LF	RF	LR	RR				
1	80.5	60.1	59.3	45.6	45.8	58.5	40.4	3.05	
10	80.4	133.8	133.3	98.8	91.0	29.66	20.12	3.01	
20	81.1	157.0	156.2	111.7	103.1	44.2	28.7	2.89	
30	81.9	172	172	117.5	109.4	40.7	24.05	2.66	
40	80.2	156.8	155.4	107.0	94.9	52.4	24.17	3.10	
50	78.9	151.5	152.1	96.8	94.7	56.7	35.07	2.99	
60	80.6	138.7	134.1	84.8	81.8	46.7	24.76	3.07	
70	80.2	133.7	128.6	80.0	75.4	52.3	34.28	2.81	
80	79.5	152.6	152.4	95.1	93.3	56.8	36.14	3.00	
90	80.4	158.0	159.3	101.3	92.9	46.8	24.17	2.91	
100	80.5	149.5	148.2	95.0	87.9	32.03	14.16	2.77	
110	77.0	131.4	132.0	90.2	84.6	56.4	34.57	2.84	
120	81.8	138.2	141.2	88.0	81.7	67.0	33.60	2.90	
130	80.7	137.9	139.0	88.3	79.2	47.6	25.99	3.06	
140	80.9	141.6	143.3	90.4	80.7	30.8	15.28	2.55	
150	80.4	140.6	141.4	90.3	81.8	51.6	25.43	3.01	
160	81.0	144.8	145.3	92.7	82.2	50.6	24.90	2.87	
170	81.2	138.4	138.8	85.0	78.7	52.4	37.79	2.61	
180	80.5	145.4	146.7	93.8	82.8	49.4	29.02	2.97	
190	80.7	167.7	174	107.0	95.5	37.8	14.24	3.04	
200	80.9	161.3	168.5	100.8	93.2	49.1	23.94	3.04	

Comments:

Brake Adjustment (Post Burnish)

Adjust to manufacturer's published recommended practice

Record method used: N/A

Adjusted by: N/A Date N/A

Tested by: Braeden Eirich Date 8/1/2019

Approved by: David Karls Date 8/8/2019

DATA SHEET 10
14.7 COLD EFFECTIVENESS @ GVWR (S7.5)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/1/2019
TEMP.:	78°F 62% ^H	WIND VELOCITY:	3-4mph 9°N	ROAD PFC:	
ODOMETER START:	337	ODOMETER FINISH:	352		

Test Weight: Total = 3,220.5 kg; Front = 1,569.4 kg; Rear = 1,651.1 kg

S.7.5.1 Vehicle conditions:

- A. Vehicle Load: GVWR
- B. Transmission Position: Neutral

S.7.5.2 Test Conditions and Procedures

NOTE: STOP IN SHORTEST DISTANCE ACHIEVABLE (BEST EFFORT) ON ALL STOPS.

IBT: ≥65°C, ≤100°C

TEST SPEED: 100km/h

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCK UP: No lockup of any wheel for longer than 0.1 seconds at speeds greater than 15 km/h

NUMBER OF RUNS: 6 stops

TEST SURFACE: PFC of 0.9

WIND SPEED: Not greater than 5 m/s

DATA SHEET 10 (CONT)

S.7.5.3 Performance Requirements

Sc for hot performance stop = 322.1 N

*STOPPING DISTANCE: ≤70 m from 100 km/h speed

RECORDED DATA: 14.7 COLD EFFECTIVENESS @ GVWR (S7.5)

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	100.4	98.8	99.9	60.9	64.1	48.9	48.5	387	322	12.24	10.12	No	YES		
2	100.0	95.1	100.2	52.7	59.7	49.0	49.0	378	346	12.55	9.89	No	YES		
3	99.4	90.2	91.9	53.6	57.2	48.9	49.5	368	315	12.65	10.12	No	YES		
4	100.5	97.9	94.6	59.5	59.3	49.7	49.1	429	389	12.60	9.95	No	YES		
5	101.0	88.7	87.4	54.9	56.8	49.7	48.8	502	422	12.10	9.70	No	YES		
6	100.6	99.6	97.4	60.7	64.6	49.6	49.0	394	355	12.56	9.70	No	YES		

$S \leq 0.10V + 0.0060V^2$ (Stopping Distance formula for vehicles with top speed of <100 km/h)

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/1/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 11
14.8 HIGH SPEED EFFECTIVENESS @ GVWR (S7.6)
(Not required if vehicle maximum speed is ≤125 km/h)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/1/2019
TEMP.:	79°F 61% ^H	WIND VELOCITY:	3mph 11°N	ROAD PFC:	0.9
ODOMETER START:	352	ODOMETER FINISH:	378		

Test Weight: Total = 3,220.5 kg; Front = 1,569.4 kg; Rear = 1,651.1 kg

S.7.6.1 Vehicle conditions:

- A. Vehicle Load: GVWR
- B. Transmission Position: In Drive

S.7.6.2 Test Conditions and Procedures

NOTE: STOP IN SHORTEST DISTANCE ACHIEVABLE (BEST EFFORT) ON ALL STOPS.

IBT: ≥65°C, ≤100°C

TEST SPEED: 80 % of vehicle maximum speed but not greater than 160 km/h

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCK UP: No lockup of any wheel for longer than 0.1 seconds at speeds greater than 15 km/h

NUMBER OF RUNS: 6 stops

TEST SURFACE: PFC of 0.9

WIND SPEED: Not greater than 5 m/s

DATA SHEET 11 (CONT)

S.7.6.3 Performance Requirements

STOPPING DISTANCE: $S \leq 0.10V + 0.0067V^2$

Calculated distance = 142.3 m

RECORDED DATA: 14.8 HIGH SPEED EFFECTIVENESS @ GVWR (S7.6)

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	138.5	101.6	96.6	58.6	60.5	91.9	104.9	417	342	12.65	9.78	No	YES		
2	135.7	92.7	93.4	53.1	57.5	88.4	105.1	409	363	12.41	9.81	No	YES		
3	135.5	99.1	98.5	58.3	62.9	84.9	101.2	394	336	12.55	10.02	No	YES		
4	135.8	95.5	93.0	56.4	59.1	86.6	102.9	411	357	12.48	9.92	No	YES		
5	135.9	100.9	97.8	58.4	61.3	84.5	100.2	435	384	12.57	10.08	No	YES		
6	135.6	97.7	94.9	56.8	58.0	85.9	102.3	468	390	12.57	10.09	No	YES		

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/1/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 12
14.9 STOPS WITH ENGINE OFF @ GVWR (S7.7)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/1/2019
TEMP.:	79°F 58% ^H	WIND VELOCITY:	4mph 26°N	ROAD PFC:	0.9
ODOMETER START:	378	ODOMETER FINISH:	396		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

S.7.7.1 General Information:

This test is for vehicles equipped with one or more brake power or assist units

S.7.7.2 Vehicle Conditions

- A. Vehicle Load: GVWR only
- B. Transmission Position: In Neutral
- C. Vehicle Engine: Off (not running)
- D. Ignition Key Position:
May be returned to "on" position after turning engine off.

S.7.7.3 Test Conditions and Procedures:

NOTE: STOP IN SHORTEST DISTANCE ACHIEVABLE (BEST EFFORT) ON ALL STOPS.

NOTE: All system reservoirs (brake power and / or assist units) are fully charged and the vehicle's engine is off (not running) at the beginning of each stop.

IBT: $\geq 65^{\circ}\text{C}$, $\leq 100^{\circ}\text{C}$

TEST SPEED: 100 km/h

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCKUP:

No lockup of any wheel for longer than 0.1 seconds at speeds > 15 km/h

DATA SHEET 12 (CONT)

NUMBER OF RUNS: 6 stops

TEST SURFACE: PFC of 0.9

WIND SPEED: Not greater than 5 m/s

S.7.7.4 Performance Requirements:

*STOPPING DISTANCE: ≤70 m from 100 km/h speed

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	100.8	97.7	96.6	54.9	58.4	48.8	48.0	421	379	12.52	10.09	No	YES		
2	101.0	99.2	99.7	58.1	61.3	48.9	48.0	420	365	12.54	10.15	No	YES		
3	100.6	98.5	98.2	56.3	59.2	48.5	47.8	447	391	11.86	9.64	No	YES		
4	100.7	98.3	99.4	54.7	60.2	47.8	47.1	436	376	11.99	9.76	No	YES		
5	100.5	99.1	98.2	55.7	59.3	47.6	47.2	414	357	11.72	9.72	No	YES		
6	101.1	99.6	94.9	58.2	57.1	49.3	48.2	412	369	12.10	9.82	No	YES		

S≤0.10V+0.0060V² (Stopping Distance formula for vehicles with top speed of <100 km/h)

For EV - describe method used to disable electric power to the vehicle propulsion motor(s) if applicable: _____ N/A

Data Indicates Compliance: YES: X NO: _____

TESTED BY: _____ Braeden Eirich DATE: _____ 8/1/2019

APPROVED BY: _____ David Karls DATE: _____ 8/8/2019

DATA SHEET 13
14.10 COLD EFFECTIVENESS @ LLVW (S7.5)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/2/2019
TEMP.:	70°F 74% ^H	WIND VELOCITY:	6-7mph 334°N/NW	ROAD PFC:	0.9
ODOMETER START:	398	ODOMETER FINISH:	410		

Test Weight: Total = 2,564.8 kg Front = 1,522.4 kg; Rear = 1,042.4 kg

REPEAT 14.7 WITH VEHICLE AT LLVW

S.7.5.3 Performance Requirements:

Sc for hot performance stop = 45.8 m

Avg. PF for hot performance stop = 348 N

*STOPPING DISTANCE: ≤70 m from 100km/h speed

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	100.3	72.4	58.5	46.4	46.1	451	338	11.93	10.23	No	YES
2	99.7	98.5	57.4	45.8	46.1	396	348	11.79	9.89	No	YES
3	100.5	97.0	48.4	46.8	46.4	386	315	11.79	8.32	No	YES
4	100.3	97.0	44.4	46.5	46.2	405	357	11.92	10.01	No	YES
5	100.6	92.8	43.0	46.2	45.7	432	380	11.92	10.18	No	YES
6	100.7	97.4	45.2	46.8	46.2	445	393	11.92	10.06	No	YES

* $S \leq 0.10V + 0.0060V^2$ (Stopping Distance formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/2/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 14
14.11 HIGH SPEED EFFECTIVENESS @ LLVW (S7.6)
(Not required if vehicle maximum speed is ≤125 km/h)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/2/2019
TEMP.:	73°F 71% ^H	WIND VELOCITY:	5-6mph 360 ^o N	ROAD PFC:	0.9
ODOMETER START:	410	ODOMETER FINISH:	430		

Test Weight: Total = 2,564.8 kg Front = 1,522.4 kg Rear = 1,042.4 kg

REPEAT 14.8 WITH VEHICLE AT LLVW

S.7.6.3 Performance Requirements:

$$\text{STOPPING DISTANCE: } S \leq 0.10V + 0.0067V^2$$

Calculated distance= 142.3 m

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	135.6	95.5	42.1	82.5	98.2	475	411	11.80	9.86	No	YES
2	135.3	93.5	42.9	82.5	98.7	442	389	11.80	9.77	No	YES
3	135.3	96.8	44.6	83.7	100.2	458	419	11.80	9.78	No	YES
4	136.5	97.2	44.6	85.9	94.8	450	204	11.80	5.51	No	YES
5	135.1	97.5	44.4	81.9	98.3	464	404	11.80	9.84	No	YES
6	134.7	99.3	45.2	82.4	99.5	410	363	11.80	9.78	No	YES

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/2/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 15
14.12 ANTILOCK FUNCTIONAL FAILURE @ LLVW (S7.8)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/2/2019
TEMP.:	76°F 63% ^H	WIND VELOCITY:	3-5mph 304°NW	ROAD PFC:	
ODOMETER START:	431	ODOMETER FINISH:	442		

Test Weight: Total = 2,564.8 kg Front = 1,522.4 kg Rear = 1,042.4 kg

S.7.8.1 Vehicle conditions:

- A. Vehicle Load: LLVW
- B. Transmission Position: In Neutral

S.7.8.2 Test Conditions and Procedures

NOTE: STOP IN SHORTEST DISTANCE ACHIEVABLE (BEST EFFORT) ON ALL STOPS.

IBT: $\geq 65^{\circ}\text{C}$, $\leq 100^{\circ}\text{C}$

TEST SPEED: 100 km/h

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCK UP:

No lockup of any wheel for longer than 0.1 seconds at speeds $> 15 \text{ km/h}$

NUMBER OF RUNS: 6 stops

TEST SURFACE: PFC of 0.9

WIND SPEED: Not greater than 5 m/s

FAILURE SIMULATION:

- A. Disconnect the functional power source, or any electrical connector that creates a functional failure

Record method used to induce failure: Removed front wheel speed sensor.

DATA SHEET 15 (CONT)

B. Brake system indicator light activated? YES X NO _____

C. Restore the system to normal at the completion of this test.

NOTE: If more than one antilock brake subsystem is provided, repeat test for each subsystem.

S.7.8.3 Performance Requirements:

*STOPPING DISTANCE: ≤85 m from 100 km/h speed

RECORDED DATA:14.12 ANTILOCK FUNCTIONAL FAILURE @ LLVW (S7.8)

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	100.9	88.7	81.9	43.6	45.9	67.1	65.9	163.8	131.9	9.60	7.54	No	YES		
2	100.3	99.0	95.3	49.9	53.7	56.8	56.5	177	145.2	10.17	8.46	No	YES		
3	100.6	100.0	98.4	49.9	52.2	56.6	56.0	168.3	145.6	10.02	8.45	No	YES		
4	100.6	100.6	98.5	48.7	49.9	57.2	56.5	157.8	137.9	10.22	8.49	No	YES		
5	101.2	96.5	97.1	47.3	48.0	57.2	55.8	163.0	136.8	9.84	8.20	No	YES		
6	103.0	97.4	100.4	47.5	49.9	97.1	91.5	158.8	118.6	10.15	7.10	No	YES		

$S \leq 0.10V + 0.0075V^2$ (Stopping Distance formula for vehicles with top speed of <100 km/h)

Data Indicates Compliance: YES X NO: _____

Comments: _____

TESTED BY: Braeden Eirich DATE: 8/2/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 17
14.14 HYDRAULIC CIRCUIT FAILURE # 1 @ LLVW (S7.10) &
FAILED ELECTRICALLY TRANSMITTED SIGNAL & FAILED RBS

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/2/2019
TEMP.:	80°F 50% ^H	WIND VELOCITY:	3-4mph 17°N/NE	ROAD PFC:	0.9
ODOMETER START:	444	ODOMETER FINISH:	456		

Test Weight: Total = 2,564.8 kg Front = 1,522.4 kg Rear= 1,042.4 kg

S.7.10 Hydraulic Circuit Failure CIRCUIT NO. 1
Or Failed Brake Signal or Failed RBS

S.7.10.1 General Information: This test is for vehicles manufactured with a split service brake system. *It is also for failed electric brake signal and failed RBS.*

S.7.10.2 Vehicle Conditions:

- A. Vehicle Load: LLVW
- B. Transmission Position: In Neutral

S.7.10.3 Test Conditions and Procedures:

NOTE: STOP IN THE SHORTEST DISTANCE ACHIEVABLE (BEST EFFORT) ON ALL STOPS.

IBT: ≥65°C, ≤100°C

TEST SPEED: 100 km/h

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCKUP:

No lockup of any wheel for longer than 0.1 seconds at speeds > 15 km/h

NUMBER OF RUNS: 4 stops

TEST SURFACE: PFC of 0.9

WIND SPEED: Not greater than 5 m/s

DATA SHEET 17 (CONT)

FAILURE SIMULATION (for hydraulic circuit, electronic brake signal, failed ABS):

Method of simulating failure: Removed primary line from the master cylinder.

System Portion Failed: Left Rear/ Right Rear.

Determine the control force pressure level (differential pressure between intact and failed subsystem) or fluid level drop, necessary to activate the brake warning indicator.

- A. Differential pressure to activate light: N/A, or
- B. Fluid level required to activate light: At min mark.
Make stops after the brake warning indicator has been activated.
- C. For failed electric brake signal or failed RBS, warning indicators activated: N/A
- D. Restore the system to normal at the completion of this test.

S.7.10.4 Performance Requirements:

*STOPPING DISTANCE: ≤ 168 m from 100 km/h speed

RECORDED DATA: 14.14 HYDRAULIC CIRCUIT FAILURE # 1 @ LLVW (S7.10) & FAILED ELECTRICALLY TRANSMITTED SIGNAL & FAILED RBS

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	100.6	70.4	30.8	65.4	64.6	401	308	10.52	7.53	No	YES
2	100.7	94.9	32.9	65.3	64.4	485	411	10.24	7.37	No	YES
3	100.6	97.5	33.9	63.3	62.5	437	383	11.90	7.45	No	YES
4	100.3	99.1	34.4	62.9	62.6	422	361	10.28	7.27	No	YES

* $S \leq 0.10V + 0.0158V^2$ (Stopping Dist. formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO:

TESTED BY: Braeden Eirich DATE: 8/2/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 18
14.14 HYDRAULIC CIRCUIT FAILURE # 2 @ LLVW (S7.10)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/2/2019
TEMP.:	81°F 47%H	WIND VELOCITY:	2-5mph 5°NE	ROAD PFC:	0.9
ODOMETER START:	458	ODOMETER FINISH:	463		

Test Weight: Total = 2,654.8 kg; Front = 1,522.4 kg Rear = 1,042.4 kg

REPEAT 14.14 With Hydraulic Circuit #2 Failure @ LLVW

S.7.10.4 Performance Requirements:

*STOPPING DISTANCE: ≤168 m from 100 km/h speed

RECORDED DATA: 14.14 HYDRAULIC CIRCUIT FAILURE # 2 @ LLVW (S7.10)

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	100.4	55.3	70.4	129.2	128.3	472	403	7.72	3.38	No	Yes
2	100.4	50.7	97.5	125.8	124.8	449	380	6.66	3.33	No	Yes
3	100.6	48.3	87.7	130.3	128.7	429	368	6.27	3.33	No	Yes
4	100.1	44.9	87.8	126.7	126.4	438	385	6.42	3.35	No	Yes

* $S \leq 0.10V + 0.0158V^2$ (Stopping Dist. formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO: _____

Comments:

TESTED BY: Braeden Eirich DATE: 8/2/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 19
14.15 HYDRAULIC CIRCUIT FAILURE # 1 @ GVWR (S7.10)
FAILED ELECTRICALLY TRANSMITTED SIGNAL & FAILED RBS

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	69°F 85% ^H	WIND VELOCITY:	0mph 252°SW	ROAD PFC:	0.9
ODOMETER START:	467	ODOMETER FINISH:	480		

Test Weight: Total = 3,220.5 kg; Front = 1,569.4 kg; Rear = 1,651.1 kg

REPEAT 14.14 With Hydraulic Circuit #1 Failure @ GVWR

S.7.10.4 Performance Requirements:

*STOPPING DISTANCE: ≤168 m from 100 km/h speed

RECORDED DATA: 14.15 HYDRAULIC CIRCUIT FAILURE # 1 @ GVWR (S7.10) FAILED ELECTRICALLY TRANSMITTED SIGNAL & FAILED RBS

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	102.2	78.5	29.0	103.3	99.0	459	360	8.02	5.93	No	YES
2	100.1	98.1	26.1	74.4	74.3	445	386	8.23	6.23	No	YES
3	101.0	96.9	27.5	74.4	72.9	468	425	8.43	6.17	No	YES
4	101.1	98.2	28.6	75.5	73.9	498	436	8.99	6.23	No	YES

* $S \leq 0.10V + 0.0158V^2$ (Stopping Dist. formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/5/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 20
14.15 HYDRAULIC CIRCUIT FAILURE # 2 @ GVWR (S7.10)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	69°F 85% ^H	WIND VELOCITY:	0mph 96°E	ROAD PFC:	0.9
ODOMETER START:	483	ODOMETER FINISH:	495		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

REPEAT 14.14 With Hydraulic Circuit #2 Failure @ GVWR

S.7.10.4 Performance Requirements:

*STOPPING DISTANCE: ≤168 m from 100 km/h speed

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	100.8	54.0	68.6	118.2	116.3	480	454	5.32	4.04	No	YES
2	100.7	49.2	86.4	112.6	111.0	483	444	5.23	3.99	No	YES
3	100.9	46.2	91.4	118.9	116.9	465	432	5.20	4.12	No	YES
4	100.3	44.8	93.9	114.0	113.4	514	443	5.39	4.14	No	YES

* $S \leq 0.10V + 0.0158V^2$ (Stopping Dist. formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/5/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 21
14.16 ANTILOCK FUNCTIONAL FAILURE @ GVWR (S7.8)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	83°F 58% ^H	WIND VELOCITY:	0mph	ROAD PFC:	0.9
ODOMETER START:	497	ODOMETER FINISH:	516		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg; Rear = 1,651.1 kg

REPEAT 14.12 WITH VEHICLE AT GVWR

S.7.8.3 Performance Requirements:

*STOPPING DISTANCE: ≤85 m from 100 km/h speed

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)		Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane
		Front	Rear			Max.	Avg.	Max.	Avg.		
1	100.8	69.8	74.8	71.8	70.7	257	182	9.47	8.00	No	YES
2	100.8	98.3	75.6	54.2	53.4	179	159.3	10.44	8.80	No	YES
3	100.6	97.8	61.3	57.2	56.6	244	162.8	10.61	9.07	No	YES
4	100.2	97.8	59.6	66.2	65.9	162.1	140.9	8.98	7.46	No	YES
5	100.3	92.0	56.0	60.8	60.5	185	162.8	9.70	8.36	No	YES
6	100.6	98.9	59.2	60.2	59.5	193	168.7	10.45	8.80	No	YES

* $S \leq 0.10V + 0.0075V^2$ (Stopping Dist. formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/5/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 23
14.18 Power Unit or Brake Power Assist Unit
Inoperative @GVWR (System Depleted) (S7.11)
& Electrical failure in the electrically- actuated service brakes

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	84°F 49% ^H	WIND VELOCITY:	4-6mph 246°SW	ROAD PFC:	0.9
ODOMETER START:	517	ODOMETER FINISH:	533		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

S7.11.1 General Information:

This test is for vehicles equipped with one or more brake power units or brake power assist units. *It is also for electrical failure in the electrically-actuated service brakes.*

S7.11.2 Vehicle Conditions:

- A. Vehicle Load: GVWR
- B. Transmission Position: In Neutral

S7.12.2 Test Conditions and Procedures:

NOTE: STOP IN THE SHORTEST DISTANCE ACHIEVABLE (BEST EFFORT) ON ALL STOPS.

IBT: ≥65°C, ≤100°C

TEST SPEED: 100 km/h

PEDAL FORCE: 65 N minimum to 500 N maximum

WHEEL LOCKUP:

No lockup of any wheel for longer than 0.1 seconds at speeds > 15 km/h

NUMBER OF RUNS: 6 stops

TEST SURFACE: PFC of 0.9

WIND SPEED: Not greater than 5 m/s

FAILURE SIMULATION:

Disconnect the primary source of power or *fail electrically-actuated service brakes*
(Deplete all reserve power capability.)

Method of rendering inoperative Removed vaccum hoses from booster.

Restore the system to normal at the completion of this test. Repeat for other power unit if vehicle has more than one.

S7.11.4 Performance Requirements:

*STOPPING DISTANCE: ≤ 168 m

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	100.5	65.9	67.0	47.7	50.7	75.8	75.1	194	84.0	11.56	3.87	No	Yes		
2	101.2	96.9	99.3	67.9	70.3	67.2	65.6	142.2	126.9	9.46	7.73	No	Yes		
3	100.9	94.7	99.9	59.1	61.8	73.7	72.4	166.2	90.9	9.60	4.56	No	Yes		
4	101.0	91.7	97.4	55.5	59.5	70.3	69.0	177	146.5	9.95	6.78	No	Yes		
5	100.9	94.2	102.9	55.4	61.4	79.8	78.3	208	137.4	10.43	6.21	No	Yes		
6	100.8	91.6	98.5	53.7	60.1	56.3	55.4	196	166.3	11.77	7.43	No	Yes		

* $S \leq 0.10V + 0.0158V^2$ (Stopping Dist. Formula for vehicles with top speed <100 km/h)

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/8/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 24
14.19 PARKING BRAKE @ GVWR (S7.12)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	86°F 51% ^H	WIND VELOCITY:	6-8mph 201°S/SW	ROAD PFC:	0.9
ODOMETER START:	535	ODOMETER FINISH:	535		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

Parking Brake: Hand Control? _____ Foot Control? _____ Electrically-Actuated? X

S7.12.1 Vehicle Conditions:

- A. Vehicle Load: GVWR
- B. Transmission Position: In Neutral
- C. Parking Brake Burnish:

For vehicles with parking brake systems not utilizing the service brake friction elements, the friction elements of such systems are to be burnished prior to parking brake tests according to the manufacturer's published recommendations as furnished to the purchaser. If no recommendations are furnished, test the system in an un-burnished condition. If recommendations are furnished, record method used. N/A

S7.12.2 Test Conditions and Procedures:

- A. Parking brake systems utilizing service brake friction materials.

IBT: ≤100°C

(No additional burnishing or artificial heating prior to the start of the parking brake test is allowed).

- B. Parking brake systems utilizing non-service brake friction materials.

IBT: Ambient Temperature

(No additional burnishing or artificial heating prior to the start of the parking brake test is allowed).

PEDAL FORCE:

Hand control: ≤400 N

Foot control: ≤500 N

Drive onto 20% grade. Apply service brake just enough to hold vehicle stationary, and shift to Neutral. Apply park brake to force of ≤ 400 N hand control and ≤ 500 N foot control.

Release service brake; If vehicle remains stationary, start the measurement of time. Terminate after 5 minutes. If vehicle is not held stationary, reapply service brake just enough to hold vehicle on the grade. Reapply the specified force to parking lever or pedal (without releasing ratchet mechanism).

Release service brake. If vehicle still doesn't hold, repeat application. If vehicle is not held stationary for 5 minutes after two re-applications, check with engineer for further instructions. Repeat test in the opposite direction.

Did parking brake indicator operate each time the parking brake was applied?

Yes: X No:

S7.12.3 Performance Requirements:

The parking brake must hold the vehicle stationary in both directions for 5 minutes.

Comments:

DATA SHEET 24 (CONT)

RECORDED DATA

	20% Grade - Uphill			20% Grade - Downhill		
	Initial Apply	1st Reapply	2nd Reapply	Initial Apply	1st Reapply	2nd Reapply
Service Brake Force to Hold Vehicle Stationary (N)	95.1	89.4	91.2	42.7	45.0	43.6
Parking Brake Force Applied (N)	6.7	6.7	6.7	6.7	6.7	6.7
Number of Clicks (Optional)	1	1	1	1	1	1
Vehicle Stationary for 5 minutes?	Yes	Yes	Yes	Yes	Yes	Yes
Initial Brake Temperature (°C)	Left	50.0	46.0	40.0	54.0	45.0
	Right	52.0	44.0	39.0	56.0	45.0
	Average	51.0	45.0	39.5	55.0	45.0

Data Indicates Compliance:

YES: X

NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/5/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 25
14.20 HEATING SNUBS @ GVWR (S7.13)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	86°F 53% ^H	WIND VELOCITY:	4mph 201 ^o S	ROAD PFC:	0.9
ODOMETER START:	537	ODOMETER FINISH:	547		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

IBT: $\geq 55^{\circ}\text{C}$, $\leq 65^{\circ}\text{C}$.

Establish IBT before the first application. IBT before subsequent snubs are those occurring at the distance intervals

TRANSMISSION POSITION: In gear

NUMBER OF SNUBS: 15

TEST SPEEDS:

The initial speed for each snub is 120 km/h or 80% of Vmax, whichever is slower. Each snub is terminated at one-half the initial speed.

DECELERATION RATE:

Maintain a constant deceleration rate of 3.0 m/s^2 . Attain the specified deceleration within one second and maintain it for the remainder of the snub.

PEDAL FORCE:

Adjust as necessary to maintain the specified constant deceleration rate.

TIME INTERVAL:

Maintain an interval of 45 seconds between the start of brake applications (snubs).

NOTE 1: Accelerate as rapidly as possible to the initial test speed immediately after each snub.

NOTE 2: Immediately after the 15th snub, accelerate to 100 km/h and commence the hot performance test.

HEATING SNUBS

RECORDED DATA

NOTE: Modify as needed according to feasibility and instrumentation.

STOP NO.	Initial SPEED (KM/H)	INITIAL BRAKE TEMPERATURE (°C) (Secondary Shoe or Hottest Pad)				MAX. PEDAL FORCE (N)	AVG. PEDAL FORCE (N)	Max. Decel. Rate (m/s ²)	Avg. Decel. Rate (m/s ²)	Time Interval	COMMENTS
		LF	RF	LR	RR						
1	120.8	64.0	65.6	43.6	48.3	94.8	17.9	2.88	2.09		
2	120.1	73.4	79.3	55.7	56.5	37.2	17.8	3.09	2.78	45.7	
3	120.2	77.1	84.6	60.3	61.3	39.6	25.1	3.40	2.78	45.09	
4	120.1	81.3	96.1	70.4	68.8	84.5	17.8	2.77	2.65	45.97	
5	119.8	102.7	119.8	88.4	88.8	36.5	13.6	3.12	3.15	46.0	
6	120.3	122.8	148.0	111.7	108.4	39.2	17.8	3.01	2.60	45.4	
7	120.4	130.5	152.4	114.1	111.5	35.9	24.8	3.50	2.80	45.1	
8	120.4	146.5	178	135.6	127.5	34.0	17.9	2.22	1.98	45.7	
9	120.8	153.4	179	134.8	129.6	39.4	18.2	3.03	2.87	45.9	
10	120.6	174	203	152.8	142.4	38.1	17.9	2.95	2.50	45.1	
11	120.0	174	203	152.6	144.0	40.8	27.1	3.42	2.55	46.2	
12	120.9	187	222	169.0	157.2	32.7	17.8	2.44	1.98	45.0	
13	120.1	194	228	169.2	163.5	37.3	28.1	3.55	2.86	45.7	
14	120.2	215	244	181	177	38.4	28.1	3.05	2.90	46.6	
15	120.6	227	253	190	183	28.6	17.9	2.85	2.71	45.52	

Data Indicates Compliance: YES: X NO:

Comments:

Tested by: Braeden Eirich Date 8/5/2019

Approved by: David Karls Date 8/8/2019

DATA SHEET 26
14.21 HOT PERFORMANCE @ GVWR (S7.14)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	86°F 53% ^H	WIND VELOCITY:	4mph 201 ^{oS}	ROAD PFC:	0.9
ODOMETER START:	547	ODOMETER FINISH:	548		

Test Weight: Total = 3,220.5 kg; Front = 1,569.4 kg Rear = 1,651.1 kg

S7.14 Hot Performance. GVWR

IBT: Temperature achieved at completion of heating snubs.

TRANSMISSION POSITION: In neutral

NUMBER OF RUNS: 2 Stops

TEST SPEEDS: 100 km/h (62.1 mph). If vehicle is incapable of attaining 100 km/h, it is tested at the same speeds used for the cold effectiveness test.

PEDAL FORCE:

Stop No. 1: Average pedal force not greater than the average pedal force recorded during the shortest GVWR cold effectiveness stop.

AVG. Pedal force from cold effectiveness stop: 167 N

NOTE: To insure Average Pedal Force is not GREATER THAN the Average Pedal Force on shortest GVWR cold effectiveness stop, driver can observe instrument panel mounted real time pedal force gauge and maintain a force lower than the average value which must NOT be exceeded.

Stop No. 2: <500 N (112.4 lbs.)

WHEEL LOCKUP: No lockup of any wheel for longer than 0.1 seconds at speeds greater than 15 km/h

DATA SHEET 26 (CONT)

Relative and Absolute Performance Requirements:

- A. For the **1st** hot stop, the stopping distance must be less than or equal to a calculated distance which is based on 60 percent of the deceleration actually achieved on the shorted GVWR cold effectiveness stop. The following equations shall be used in calculating the performance requirement.

$$D_c = 0.0386V^2 / (S_c - 0.10V)$$

$$S = 0.10V + (0.0386V^2 / 0.60D_c), \text{ where}$$

S_c = actual stopping distance measured on the shortest cold effectiveness stop at GVWR (m/s)

V = cold effectiveness test speed (km/h)

D_c = the average deceleration actually achieved during the shortest cold effectiveness stop at GVWR (m/ss)

S = stopping distance.

- B. In addition to the requirement above, the stopping distance for **at least one** of the two hot stops must be $S \leq 89$ m (292 ft.) from a test speed of 100 km/h or, for reduced test speed $S \leq 0.10V + 0.0079V^2$. The results of the second stop may not be used to meet the requirement of the first stop.

NOTE 1: Accelerate as rapidly as possible to the initial test speed immediately after each stop.

NOTE 2: Immediately after the hot performance stops, drive 1.5 km at 50 km/h before the first cooling stop.

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	100.8	232	260	195	189	46.6	45.9	161	70.0	11.88	9.64	No	Yes		
2	100.2	258	276	202	198	60.2	60.3	164	136	11.88	9.33	No	Yes		

Data Indicates Compliance:

Comments: YES: NO:

TESTED BY: X Braeden DATE: 8/5/2019

APPROVED BY: E David Karls DATE: 8/8/2019

DATA SHEET 27
14.22 BRAKE COOLING @ GVWR (S7.15)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	86°F 53% ^H	WIND VELOCITY:	4mph 201 ^{oS}	ROAD PFC:	0.9
ODOMETER START:	548 mile	ODOMETER FINISH:	552		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

S7.15 Brake Cooling Stops: GVWR

IBT: Temperature achieved at completion of hot performance.

TRANSMISSION POSITION: In gear

NUMBER OF RUNS: 4 Stops

TEST SPEEDS: 50 km/h (31.1mph)

PEDAL FORCE:

Adjust as necessary to maintain specified constant deceleration rate

DECELERATION RATE:

Maintain a constant deceleration rate of 3.0 m/s²

WHEEL LOCKUP:

No lockup of any wheel for longer than 0.1 seconds at speeds > 15 km/h

NOTE 1: Immediately after the hot performance stops, drive 1.5 km at 50 km/h before the first cooling stop.

NOTE 2: For the first through third cooling stops, immediately accelerate at the maximum rate to 50 km/h. Maintain that speed until beginning the next stop at a distance of 1.5 km from the beginning of the previous stop.

NOTE 3: Immediately after the fourth stop, accelerate at the maximum rate to 100 km/h. Maintain that speed until beginning the recovery performance stops at a distance of 1.5 km after the beginning of the fourth cooling stop.

DATA SHEET 27 (CONT)

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	49.8	254	266	188	181	41.7	42.2	52.2	42.9	3.52	2.88				
2	50.1	214	222	153.9	138.3	42.5	42.3	53.1	41.4	3.51	2.87				
3	50.1	181	188	127.8	114.3	41.5	41.4	175	46.7	3.45	2.89				
4	50.0	154.6	162.6	104.7	97.3	42.3	42.2	57.2	46.6	3.34	2.82				

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/5/2019

APPROVED BY: David Karls DATE: 8/8/2019

DATA SHEET 28
14.23 RECOVERY PERFORMANCE @ GVWR (S7.16)

VEHICLE:	Ram 1500	UNIT NUMBER:	C20190303	DATE:	8/5/2019
TEMP.:	86°F 53% ^H	WIND VELOCITY:	4mph 201 ^{oS}	ROAD PFC:	0.9
ODOMETER START:	552	ODOMETER FINISH:	553		

Test Weight: Total = 3,220.5 kg Front = 1,569.4 kg Rear = 1,651.1 kg

S7.16 Recovery Performance. GVWR

NOTE: The recovery performance test is conducted immediately after completion of the brake cooling stops.

IBT: Temperature achieve at completion of cooling stops.

TRANSMISSION POSITION: In neutral

NUMBER OF RUNS: 2 Stops

TEST SPEED:

100km/h (62.1 mph). If vehicle is incapable of attaining 100 km/h, it is tested at the same speeds used for the cold effectiveness test.

PEDAL FORCE:

Average pedal force not greater than the average pedal force recorded during the shortest GVWR cold effectiveness stop. 167 N

WHEEL LOCKUP:

No lockup of any wheel for longer than 0.1 seconds allowed at speeds greater than 15 km/h

Immediately after the 4th cooling stop, accelerate at the maximum rate to 100 km/h. Maintain that speed until beginning the 1st recovery performance stop at a distance of 1.5 km after the beginning of the 4th cooling stop

Immediately after completion of the 1st recovery performance stop, accelerate as rapidly as possible to the specified test speed and conduct the 2nd recovery performance stop.

DATA SHEET 28 (CONT)

Performance Requirements: The stopping distance S for **at least one** of the two stops must be within the following limits:

$$S - 0.10V \geq (0.0386 V^2 / 1.50D_c), \text{ and}$$

$$S - 0.10V \leq (0.0386 V^2 / 0.70D_c), \text{ where}$$

V = cold effectiveness test speed (km/h)

D_c = the average deceleration actually achieved during the shortest cold effectiveness stop at GVWR (m/s²)

RECORDED DATA

Stop No.	Test Speed (km/h)	Initial Brake Temp. (°C)				Actual Stopping Distance (m)	Corrected Stopping Distance (m)	Pedal Force (N)		Vehicle Decel. (m/s ²)		Wheel Lockup	Stay In Lane		
		Front		Rear				Max.	Avg.	Max.	Avg.				
		L	R	L	R										
1	101.3	150	163	100	89	41.3	41.0	161	70.0	11.05	9.74	No	Yes		
2	101.2	197	204	141	130	44.6	44.8	164	136	11.18	9.30	No	Yes		

Data Indicates Compliance: YES: X NO:

Comments:

TESTED BY: Braeden Eirich DATE: 8/5/2019

APPROVED BY: David Karls DATE: 8/8/2019

Test Completion Inspection (7.17)

Vehicle: 2019 Ram 1500

ODO.: 561 mi. DATE: 08-05-2019

BRAKE SYSTEM INTEGRITY (S5.6) (S7.17)

No detachment or fracture of any components such as brake springs, brake shoe, or disc pad facing. All mechanical components shall be intact and functional. Friction facing tearout shall not exceed 10% of the lining on any single frictional element. No visible brake fluid or lubricant on the friction surface of the brake. No leakage at any system reservoir cover, seal, or filler opening.

Friction Material Condition: Primary/Inner		Friction Material Condition: Secondary/Outer	
LF	Glazing, light streaks.	LF	Glazing, light streaks.
RF	Glazing, light streaks.	RF	Glazing, light streaks.
LR	Okay, light glazing.	LR	Okay, light glazing.
RR	Okay, light glazing.	RR	Okay, light glazing.
Drum (or Rotor) Condition:		Brake Fluid/Lubricant Inside Brakes:	
LF	Light glaze, material transfer.	LF	Normal appearance.
RF	Light glaze, material transfer.	RF	Normal appearance.
LR	Light glaze, material transfer.	LR	Normal appearance.
RR	Light glaze, material transfer.	RR	Normal appearance.
Hydraulic Component Condition:		Mechanical Component Condition:	
LF	Good	Brk/Ped	Good
RF	Good	Pow/Brk	Good
LR	Good	Stop/Lamp	Good
RR	Good	Linkage	Good
M/Cyl	Good	Other	Good

COMPLIANCE: Yes: X No:

Comments: None.

Technician: Braeden

Eirich

TEST COMPLETION INSPECTION (S7.17)

Vehicle: 2019 Ram 1500

MASTER CYLINDER RESERVOIR:

GVWR: 3,220.5kg

DATE			Requirements	Pass	Fail	
Reservoir Compartments (S5.4.1)						
(1) Does master cylinder have a reservoir compartment for each brake subsystem?	<u>Yes</u>		Master cylinder shall have a reservoir compartment for each subsystem.	X		
	No					
(2) Does loss of fluid in one compartment result in complete loss from another compartment?	Yes		Loss of fluid from one compartment shall not cause complete loss from another compartment.	X		
	<u>No</u>					
Reservoir Capacity (S5.4.2)						
Shall conform to requirements (1) or (2), state units:						
(1) For reservoirs having completely separate compartments for each subsystem (two separate, independent reservoirs):						
Subsystem 1 Subsystem reservoir capacity	636 ML	Each compartment (reservoir) shall have a minimum capacity equivalent to the fluid displacement resulting when all wheel cylinders or caliper pistons serviced by that independent compartment/reservoir moves from a new lining, fully retracted position to a fully worn, properly adjusted, fully applied position. (Use CALCULATION OF MINIMUM RESERVOIR VOLUME REQUIREMENTS Data Sheet.)	NA	NA		
Subsystem 1 Fluid displaced from new to worn lining	137.1 ML					
Subsystem 2 Subsystem reservoir capacity	660 ML					
Subsystem 2 Fluid displaced from new to worn lining	56.9 ML					
2) For reservoirs utilizing a portion of the reservoir for a common supply to two or more subsystems:						
Total minimum capacity for the entire master cylinder reservoir (includes individual compartment reservoirs)	648 ML	Shall have total minimum capacity for entire reservoir for displacement resulting from all subsystem wheel cylinders or caliper positions moving from new lining to full worn condition as above.	X			
Fluid displaced from new to worn linings (ALL linings)	388 ML					
*Value calculated from CALCULATION OF MINIMUM RESERVOIR VOLUME REQUIREMENTS Data Sheet						

Comments: None

Technician: Braeden Eirich

TEST COMPLETION INSPECTION (S7.18)

Vehicle: 2019 Ram 1500

GVWR: 3,220.5 kg

MASTER CYLINDER RESERVOIR:

DATE		Requirements	Pass	Fail
Master Cylinder Piston Displacement(S5.4.2) [If Common Reservoir Supply – continued from previous page]				
Fluid displaced by three strokes of master cylinder piston for Subsystem No. 1.	40 ML	Individual partial compartments of reservoir shall each have a minimum of fluid equal to at least the volume displaced by the master cylinder piston servicing the subsystem during a <u>full stroke</u> of the piston. NOTE: Procedure uses three strokes to ensure an accurate measurement.		
Fluid displaced by three strokes of master cylinder piston for Secondary (Subsystem No. 2)	50 ML			
Fluid displaced per stroke, Subsystem No. 1.	13.33 ML			
Fluid displaced per stroke, Subsystem No. 2.	16.66 ML			
Fluid available in partial compartment Subsystem No. 1	42 ML		X	
Fluid available in partial compartment Subsystem No. 2	68 ML		X	
Brake Power Unit Reservoir (S5.4.2)				
Volume displaced in charging system piston or accumulator to normal operating pressure plus wheel cylinder or caliper piston displacement.		Shall have a capacity at least equal to fluid displacement required to charge the system pistons on accumulators to normal operating pressure <u>plus</u> displacement when wheel cylinders or caliper pistons move from new lining to full worn condition as above.	NA	
Reservoir Labeling (S5.4.3)				
Exact copy of reservoir label: On top of master cylinder reservoir: <u>WARNING CLEAN FILLER CAP BEFORE REMOVING. USE ONLY DOT 3 OR DOT 4 BRAKE FLUID FROM A SEALED CONTAINER.</u>		Label shall read: "Warning, clean filler cap before removing; use only * fluid from a sealed container". * Fluid type specified in 49 CFR 571.116	X	
Measure letter height	3.2 mm	Letters shall be at least 3.2 mm/ 0.125" high	X	
Describe label attachment method and location. <u>Embossed on the top of the master cylinder reservoir cap and on the top of the master cylinder reservoir.</u>	<u>Embossed</u>	Lettering shall be permanently affixed, engraved or embossed and located so as to be visible by direct view either on or within 100 mm/3.94 inches of the brake fluid reservoir filler plug or cap.	X	
Does the lettering contrast with the background?	<u>Yes</u>	If label is not engraved or embossed , letters shall be of a color that contrasts with the background	X	
	<u>No</u>			

Comments: None

Technician: Braeden Eirich

TEST COMPLETION INSPECTION (S7.18)

Vehicle: 2019 Ram 1500

DATE: 08-05-2019

BRAKE SYSTEM WARNING INDICATOR (S5.5)

CONDITION	ANSWER	REQUIREMENTS	PASS	FAIL
Brake Systems Indicator Lamp Function Check (S5.5.2) (Bulb and systems check)				
Describe location of brake indicator lamp: <u>Located in the driver's information display.</u>	Bottom Right	Shall be in front, and in clear view, of driver.	X	
Does lamp light with ignition (start) switch at ON/RUN?	Yes	Automatic activation when ignition switch is "on" when engine not running , or ignition between "on" and "start" if is manufacturer check position- OR -single manual action by driver	X	
Does lamp light with ignition between ON and Start?	Yes			
Brake check description in owner's manual?	Yes	Manufacturer shall explain the brake check function test procedure in the owner's manual.	X	
Brake System Warning Indicator ACTIVATION (S5.5.1) DURATION (S5.5.3) FUNCTION (S5.5.4)				
CONDITION	Light ON?	REQUIREMENT	PASS	FAIL
A. In event of hydraulic leak (1) On or before appearance of pressure differential of 218 psi (split system) (2) If any reservoir falls below either "safe" level or 25% of capacity, whichever is greater. Values: 150 <u>ml</u> or cc remaining = 44.6 % (3) On or before supply pressure to brake power unit falls to 50%	NA Yes NA	When ignition (Start) switch is ON , lamp must light whenever (A), (B), (C), or (D) occurs. In addition, if service brake system is not a split system, audible warning must be activated when any condition in (A) exists. Visual warning indicator for non-split systems must be flashing.	X	
B. Electrical functional failure in an antilock or variable brake proportioning system. C. Application of the parking brake. D. Brake lining wear-out if optical warning. E. For a vehicle with <u>electrically-actuated service brakes</u> , failure of the source of electric power to the brakes or diminution of state of charge of the batteries. F. For a vehicle with <u>electric transmission of the service brake control signal</u> , failure to a brake control circuit. G. For an EV with RBS that is part of the service brake system failure of RBS. Must have Audible alarm if not split system and a condition in (a) above exists? If condition (A) (2) above does not exist, then fluid reservoir must be transparent for fluid check without the need for reservoir to be opened? (S5.4.4) Indicator lamps remain activated as long as condition exists - ignition "on", and engine on or off? _____ (S5.5.3 DURATION)) Visual warning – continuous or flashing? Audible warning –continuous or flashing?	Yes Yes No NA N/A N/A Yes Yes-cont. NA		X	

Comments:

Technician: Braeden Eirich

TEST COMPLETION INSPECTION (S7.18)

Vehicle: 2019 Ram 1500

DATE: 08-05-2019

BRAKE SYSTEM WARNING INDICATOR LABELING (S5.5.5)

CONDITION AND REQUIREMENT	ANSWER NOTE: Standard requires that the answer to questions be YES	PASS	FAIL
Are visual indicators legible to driver in daylight and nighttime conditions when activated?	Yes	X	
Are visual indicator words 3.2 mm (.125") high minimum? Record Height: "Brake" – <u>3.2 mm</u> ; "ABS" – <u>3.2 mm</u> ;	Yes	X	
Visual indicator words and background contrasting colors, one of which is red. Record colors <u>Letters –Red, Lens – Black</u>	Yes	X	
If split system, is there one brake indicator? If yes, does it say the word "Brake"? (With one symbol adjacent.)	Yes	X	
If not split system; is there a separate indicator for loss of fluid or fluid pressure? Does this indicator say "Stop-Brake Failure"? Are the letters block and not less than 6.4 mm (.25") in height? Record letter height _____	NA		
If separate indicator for: 1. Low brake fluid per S5.5.1(a)(1), does indicator say "Brake Fluid"? NOTE: not required for mineral oil system Record wording: <u>NA</u> 2. Gross pressure loss per S5.5.1(a)(2), does indicator say "Brake Pressure"? Record wording: <u>NA</u> 3. Electrical functional failure in antilock or variable proportioning system per S5.5.1(b), letters and background contrasting colors one of which is yellow? Record colors <u>Lens – Black, Letters – Yellow</u> . Does indicator say "Antilock" or "ABS" or "Brake Proportioning"? Record wording: <u>" ABS"</u> . 4. Parking brake per S5.5.1(c), does indicator say "Park" or "Parking Brake"? Record wording: _____ 5. Brake lining wear-out per S5.5.1(d), does indicator say "Brake Wear"? Record wording - <u>NA</u> 6. If separate indicator for RBS, the letters and background shall be of contrasting colors, one of which is yellow. The indicator shall be labeled "RBS". RBS failure in a system which is part of the service brake system may also be indicated by a yellow lamp that also indicates "ABS" failure and displays the symbol "ABS/RBS." Record wording: _____ 7. For any other function? If yes, Record <u>NA</u>	NA NA Yes NA NA NA	X	

DATA INDICATES COMPLIANCE: YES X NO _____

Comments: None

Technician: Braeden Eirich

CALCULATION OF MINIMUM RESERVOIR VOLUME REQUIREMENTS

VEHICLE: 2019 Ram 1500

DATE: 08-05-2019

BRAKE		LINING					
LOCATION	TYPE	DESCRIPTION	MINIMUM THICKNESS	THICKNESS TO FULLY WORN (1) mm*			
Left Front	Drum	Leading	Pre-test 13.53 mm				
		Primary	Post Test 13.08 mm				
		Inboard X	Δ 0.45 mm				
	Disc X	Trailing	Pre-test 13.33 mm				
		Secondary	Post Test 12.73 mm				
		Outboard X	Δ 0.60 mm				
LINING CLEARANCE:	Diametrical (2): N/A	Inboard – app 0 mm.	Outboard – app 0 mm.				
WHEEL CYLINDER DIAMETER (3) N/A		CALIPER PISTON DIAMETER (3): 57.02 x2 pistons					
SHOE CAGE DIAMETER (4) <u>N/A</u> ; CENTER POINT OF BRAKE ASSY TO CENTER POINT OF W.C. <u>N/A</u>							
Right Rear	Drum	Leading	Pre-test 11.71 mm				
		Primary	Post Test 11.54 mm				
		Inboard X	Δ 0.17 mm				
	Disc X	Trailing	Pre-test 11.38 mm				
		Secondary	Post Test 11.14 mm				
		Outboard X	Δ 0.24 mm				
LINING CLEARANCE:	Diametrical (2) NA	Inboard – app 0 mm	Outboard – app 0 mm				
WHEEL CYLINDER DIAMETER (3): NA		CALIPER PISTON DIAMETER (3): 56.04 x1 piston					
SHOE CAGE DIAMETER (4): NA		CENTER POINT OF BRAKE ASSY TO CENTER PT. OF W.C.: NA					
CIRCUIT #1 CONSISTS OF:	LF-X	LR-X	RF	RR-X			
CIRCUIT #2 CONSISTS OF:	LF-X	LR-X	RF-X	RR			
(1) MFRS. RECOMMENDATIONS – FRONT and REAR: NA							
(2) DRUM BRAKES, MEASURED AT HORIZONTAL CENTERLINE: NA							
(3) MFRS. DATA: NA							
(4) RESET POSITION: NA							

Comments: None.

Technician: Braeden Eirich

Determination of Master Cylinder Volume Requirement

Determining the minimum volume requirements. The measured data is taken from the previous page, and the manufacturer's data is taken from Appendix E (when made available).

DISC BRAKES

Volume Required, $V_r = (\Delta t_i + t_{ic} + \Delta t_o + t_{oc}) \times [\pi (D^2)]/4$, where

V_r	= Volume required per wheel
Δt	= Change in thickness (average)
i	= Inboard
o	= Outboard
D	= Caliper cylinder diameter
c	= Average clearance

DRUM BRAKES

Volume Required, $V_r = ((2C + \Delta t_s + t_p) / \cos \alpha) \times \pi r^2$, $\alpha = \sin^{-1}(2 Y/D)$, where

V_r	= Volume required per wheel
C	= Manufacturer's recommended drum-to-lining clearance
Δt_p	= Change in thickness of primary lining
Δt_s	= Change in thickness of secondary lining
Y	= Center point of wheel cylinder to center point of brake assembly
r	= Radius of wheel cylinder bore
D	= Cage diameter

Vehicle: 2019 Ram 1500

Subsystem 1	RF	LR	Totals
	137.1 ml	56.9 ml	194.0 ml
Subsystem 2	LF	RR	
	137.1 ml	56.9 ml	194.0 ml

*TOTAL VOLUME REQUIRED = $V_t = V_{r1} + V_{r2} = 72.1 + 72.1 = 388.0 \text{ ml}$

4.0 **NOTICE OF POSSIBLE NON-COMPLIANCE**

This vehicle (Ram 1500) appears to meet the requirements of the FMVSS 135 Standard.

5.0 **PHOTOGRAPHS**

Photographs to document the vehicle, the instrumentation and ballast used, plus any other pertinent information are included in this report.

**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

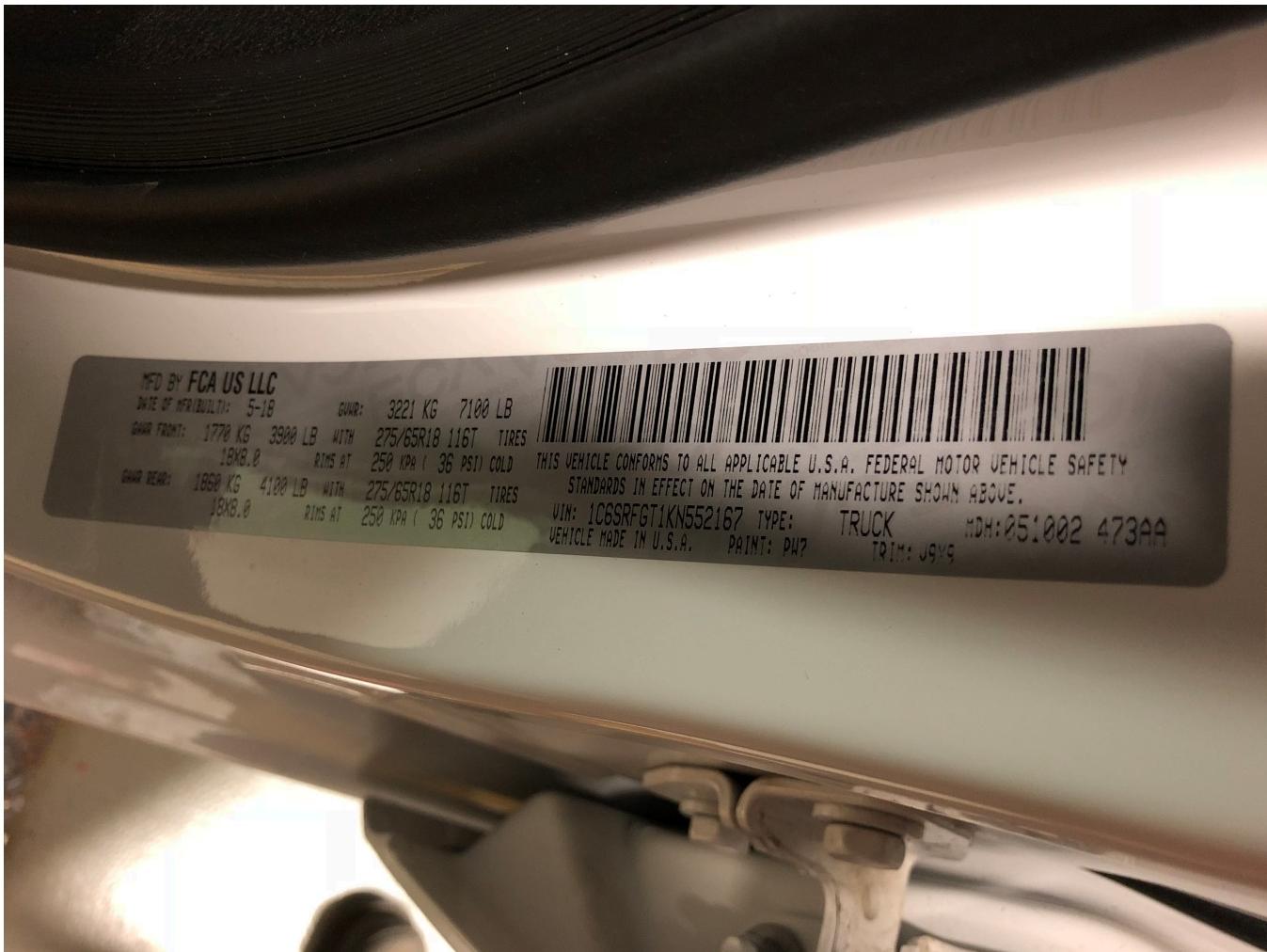
Front 3/4 Picture

**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



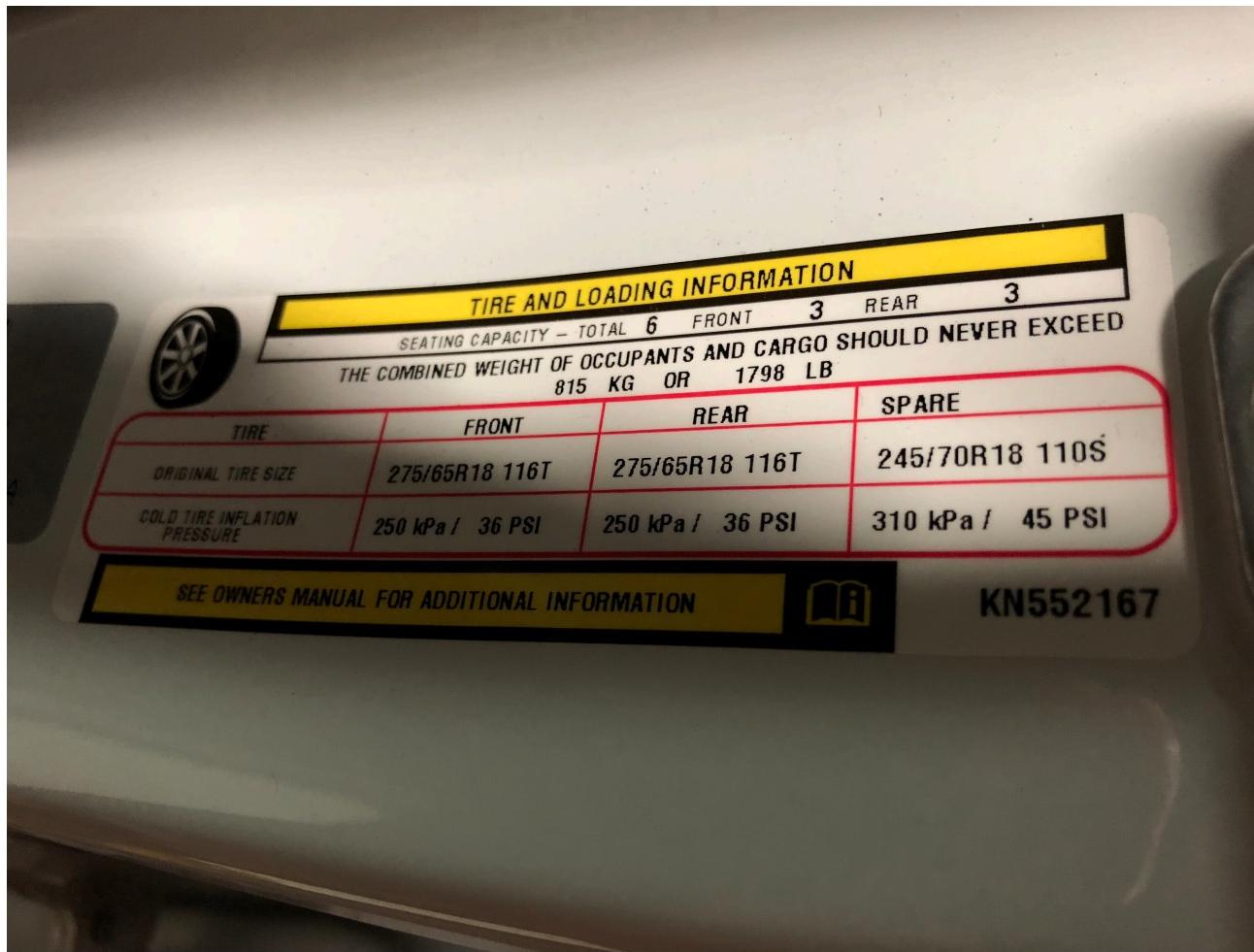
Rear 3/4 Picture

**2019 Ram 1500
FMVSS 135
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August 5, 2019**



Certification Label

2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019



Weight Label

**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

Instrumentation in vehicle

**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

Instrumentation in vehicle

**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

Pedal Force in vehicle

**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

GPS on vehicle

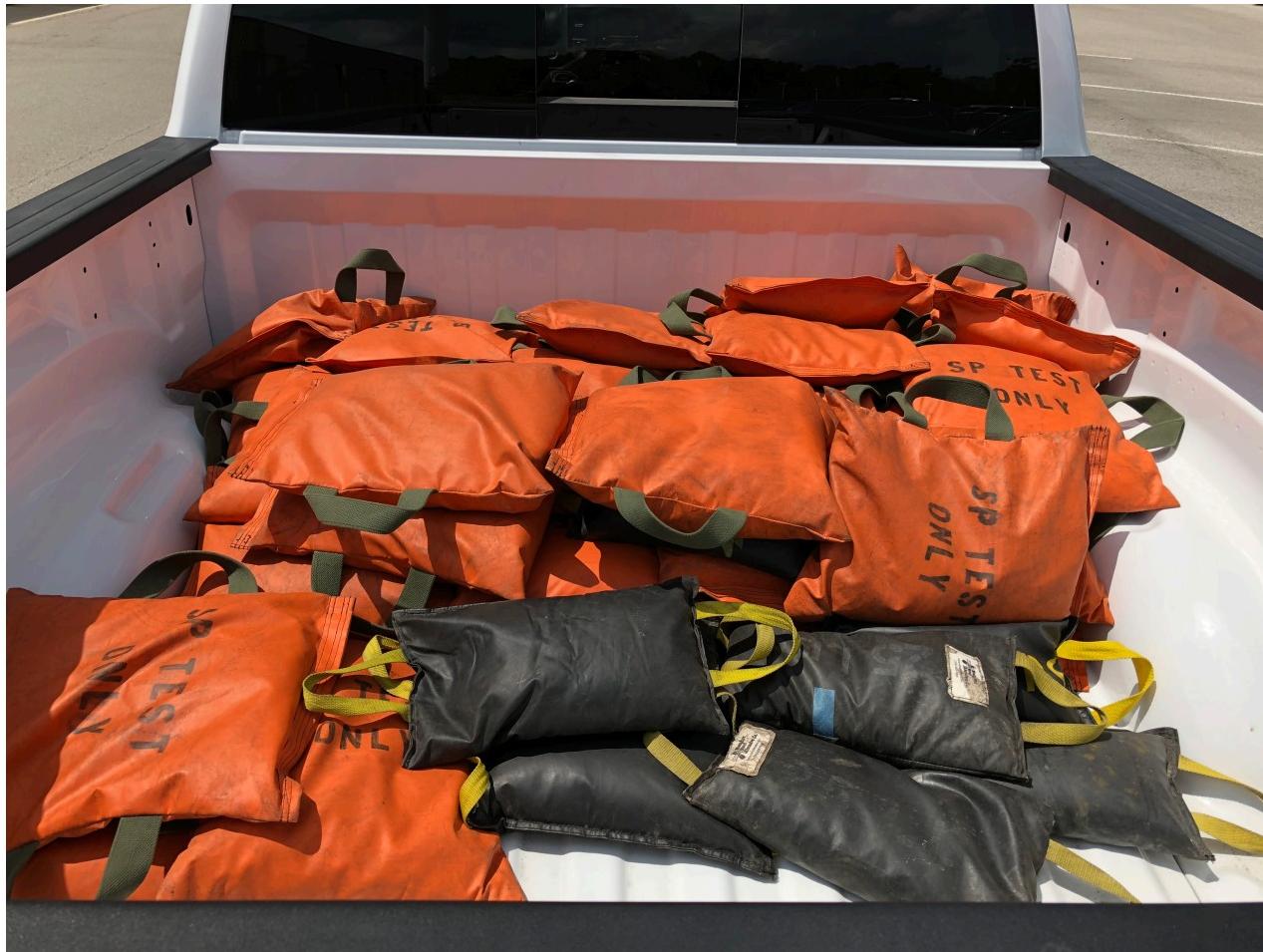
**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

Weight Scale

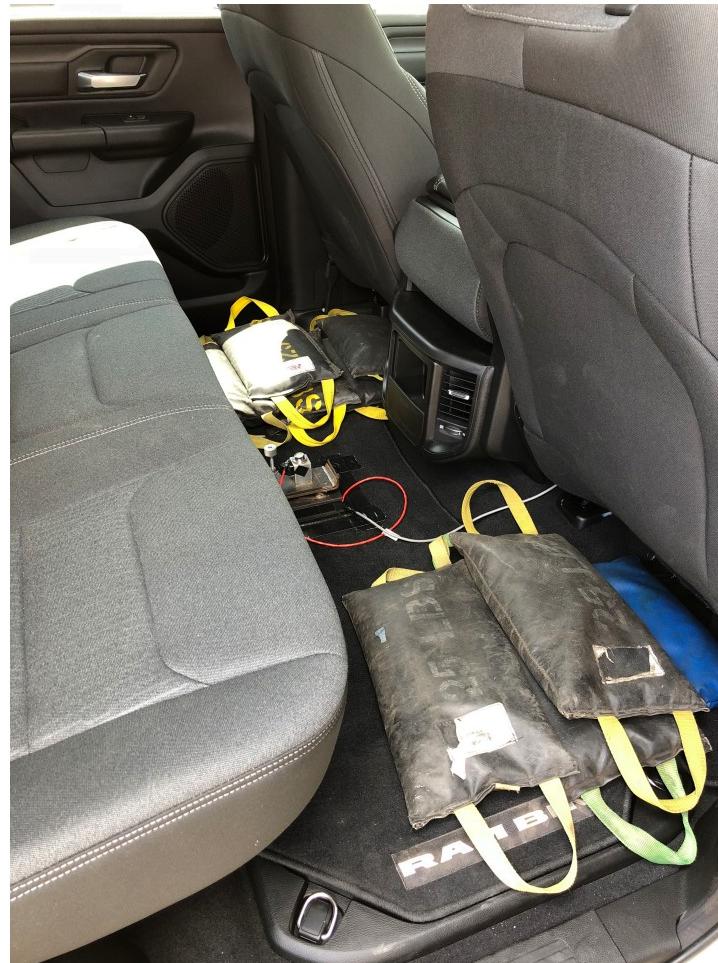
**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

Ballast in vehicle

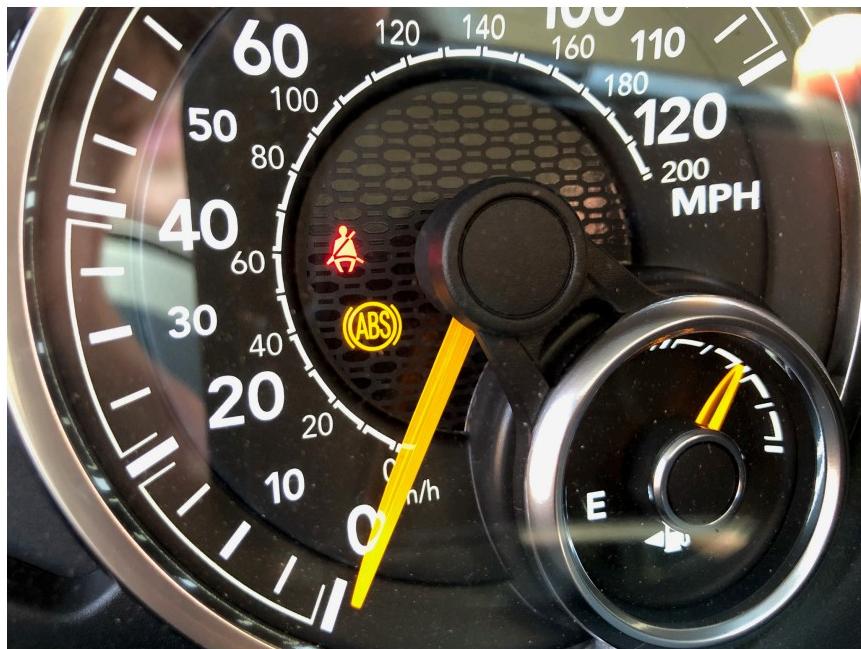
**2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019**



TRC

Ballast in vehicle

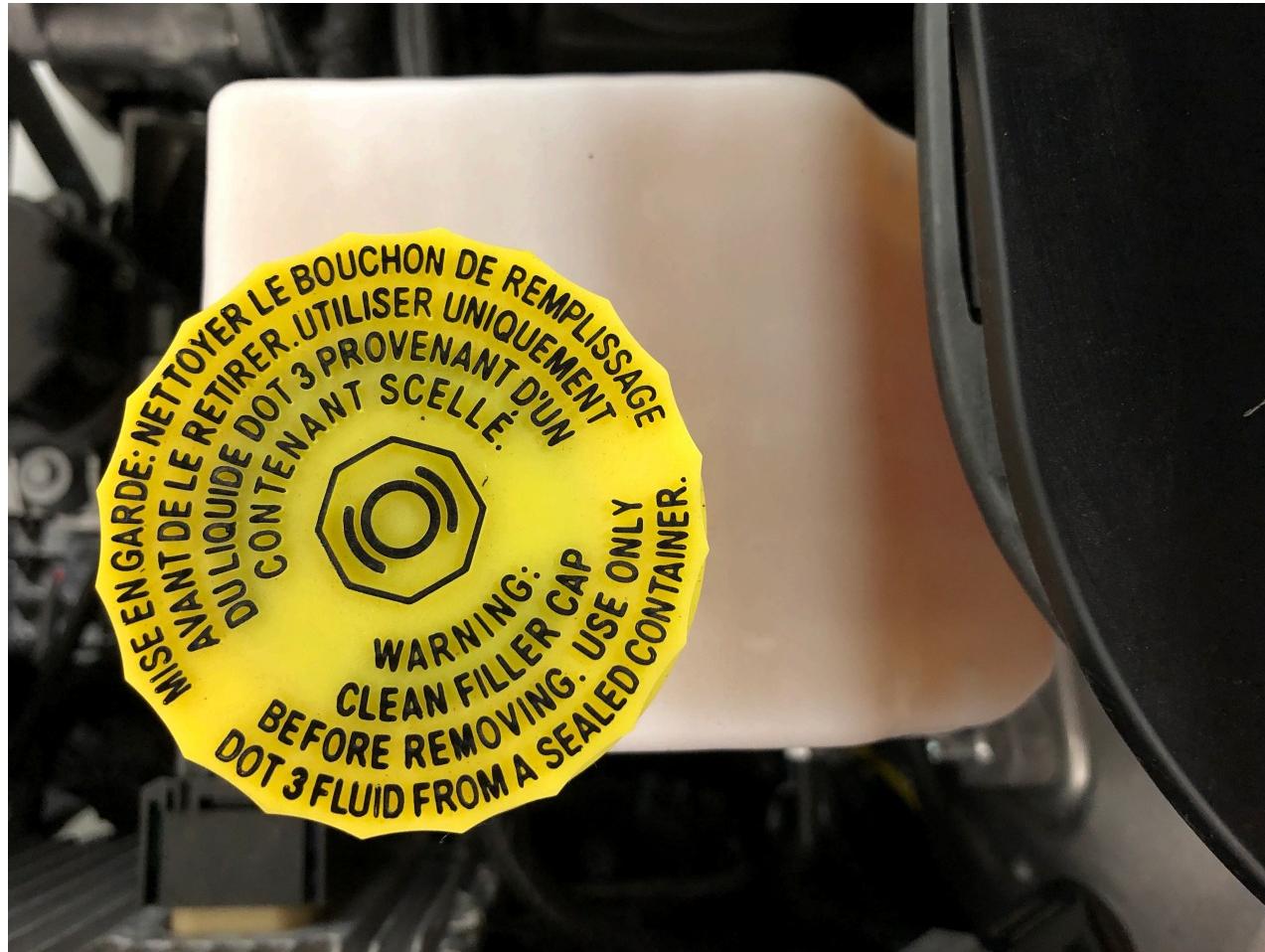
2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019



TRC

ABS and Brake Light on dash

2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019



TRC

Brake Fluid resevoir in vehicle

6.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

A calibration is included here that documents the instrumentation used on this tests and the calibration dates.

Instrumentation Calibration (1 of 3)

Year	2019
Make & Model	Ram 1500
Unit Number	C20190303

Accelerometer Pre-Test Linearity Check

(Decel)

Date		07-30-2019
Actual (m/s/s)	Rec. (m/s/s)	
0.0	0.0	
3.0	3.0	
6.1	6.1	
9.8	9.8	

Daily Calibration Check

Level to zero, then tilt 90 degrees for full scale

Desired full scale value is: 9.81 m/s/s

Allowed deviation is: +/- 0.15 m/s/s

Date	Time	Zero	Cal	
07-30-2019	10:00 AM	0.00	9.80	Pre-Test
08-01-2019	6:30 AM	0.00	9.80	
08-02-2019	6:30 AM	0.00	9.80	
08-05-2019	7:30 AM	0.00	9.80	
08-05-2019	3:00 PM	0.00	9.80	Post-Test

PoPost-Test Linearity

Check Date		08-05-2019
Actual (m/s/s)	Rec. (m/s/s)	
0.0	0.0	
3.0	3.0	
6.1	6.2	
9.8	9.9	

Service Brake Pedal Force

Pre-Test Linearity Check

Date		07-30-2019
Actual m/s/s	Rec. (m/s/s)	
FForce (N)	Force N	
0	0	
222	223	
445	445	
498	498	

PoPost-Test Linearity

Check		08-05-2019
Actual	Recorded	
Force N	Force N	
0	0	
222	222.0	
445	444.77	
498	496.87	

Instrumentation Calibration (2 of 3)

Year	2019
Make & Model	Ram 1500
Unit Number	C20190303

Distance

Drive on a measured kilometer

Desired full scale value is: 1000 m

Allowed deviation is: 3 m

Date	Time	Distance	
07-30-2019	10:00 AM	1,000.03	Pre-Test
08-01-2019	6:30 AM	1,000.00	
08-02-2019	6:30 AM	1,000.30	
08-05-2019	7:30 AM	1,000.09	
08-05-2019	3:00 PM	1,000.18	Post-Test

Speed Sensor Drive vehicle at a steady 100 km/h through a kilometer.

Desired time value is: 36 seconds

Allowed deviation is: +/- 0.5 seconds

Date	Time	Time (Sec.)	
07-30-2019	10:00 AM	35.98	Pre-Test
08-01-2019	6:30 AM	36.01	
08-02-2019	6:30 AM	35.94	
08-05-2019	7:30 AM	36.04	
08-05-2019	3:00 PM	36.02	Post-Test

Year	2019
Make & Model	Ram 1500
Unit Number	C20190303

Wheel Speed While stopped, verify all wheel speeds read "0."

Then travel at approximatley 15 km/h and assure wheel speeds match vehicle speed.

Date	Time	Zero				Match Vehicle Speed?				Pre-Test
		LLF	FRfF	LR	RR	LLF	RFF	LR	RR	
08-01-2019	2:30 PM	Y	Y	Y	Y	Y	Y	Y	Y	
08-02-2019	6:30 AM	Y	Y	Y	Y	Y	Y	Y	Y	
08-05-2019	7:30 AM	Y	Y	Y	Y	Y	Y	Y	Y	
08-05-2019	3:00 PM	Y	Y	Y	Y	Y	Y	Y	Y	Post-Test

Park Brake Force	Pedal	N/A
	Lever	N/A

Pre-Test

Date	N/A
Actual	Recorded
Force N	Force N
0	0
222	0
445	0
498	0

Note: 498 only used for Pedal

Date	N/A
Actual	Recorded
Force N	Force N
0	0
222	0
445	0
498	0

Note: 498 used for Pedal

APPENDIX A
Copy Manufacture's Sticker

2019 Ram 1500
FMVSS 135
NHTSA No. 20190303
August 5, 2019

2019 MODEL YEAR
RAM 1500 TRADESMAN CREW CAB 4X4

THIS VEHICLE IS MANUFACTURED TO MEET SPECIFIC UNITED STATES REQUIREMENTS. THIS VEHICLE IS NOT MANUFACTURED FOR SALE OR REGISTRATION OUTSIDE OF THE UNITED STATES.

MANUFACTURER'S SUGGESTED RETAIL PRICE OF THIS MODEL INCLUDING DEALER PREPARATION

Base Price: \$37,999

STANDARD EQUIPMENT (UNLESS REPLACED BY OPTIONAL EQUIPMENT)

FUNCTIONAL/SAFETY FEATURES

- Advanced Headache Front Air Bags
- Supplemental Front Side Air Bags
- Supplemental Side-Curtain Front / Rear Air Bags
- 3.2L Rear Axle Ratta
- Keyless Go®
- Remote Keyless Entry w/ Push-Button Start
- ParkView® Rear Back-Up Camera
- Safety Canopy Side-Door Deflation System
- 4-Wheel Disc Anti-Lock Brakes
- Electric Park Brake
- Ready-Alert Braking
- Rain Brake Support
- Tire-Fill Alert
- Electric Roll Mitigation
- Electronic Stability Control
- Trailer Sway Damping
- Hill Start Assist
- Speed Control
- Black Cloth Seats
- Glass III Receiver-Hitch
- 7-Pin Wiring Harness
- Capless Fuel-Fill

INTERIOR FEATURES

- Uconnect® 3 with 5-inch Display
- Cluster 3.5-inch TFT Display
- Infotainment Control with Bluetooth®
- Media Hub 2 USB, Full Function, Aux 12-Volt Auxiliary Power Outlet
- 6-Speakers
- 4-Way Manual Adjustable Driver Seat
- Front Passenger Side Manual Adjust 4-Way
- 200-Watt In-Floor Stereo Amplifier
- Power Windows w/ Front 1-Touch Up and Down Feature
- Front / Rear Climate-Control Outlets
- Steering Wheel Mounted Shift Control
- Tilt/Telescope Steering Column

EXTERIOR FEATURES

- 18.0-Inch x 7.5-Inch Steel Painted Wheels
- 275/65R18 BSW All-Season Tires
- 18-Inch All-Size Steel Spare Wheel
- Power-Heated Mirrors w/ Manual Fold-Away
- Automatic Headlamps
- Halogen Quad Headlamps
- Cargo Tie-Down Loops
- Locking Tailgate

OPTIONAL EQUIPMENT (May Replace Standard Equipment)

Customer Preferred Package 25A

- Chrome Appearance Group \$995
- 18.0-Inch x 8.0-Inch Premium Paint Cast Wheels
- Bright Front Bumper
- Bright Rear Bumper
- Trademaster Chrome Grille
- Level 1 Equipment Group \$1,555
- Cloth 40 / 20 / 40 Bench Seat
- Front and Rear Floor Mats
- Cargo Floor Covering
- Rear Privacy Window
- SiriusXM® Sat Radio w/ 1-Yr Sub Call 800-643-2112
- Three Rear Seat Head Restraints
- Anti-Slip Differential Rear Axle
- 5.7-liter V8 HEMI® MDS VVT Engine
- Active Noise-Control System
- Class IV Receiver-Hitch \$345

DESTINATION CHARGE \$1,645

TOTAL PRICE: * \$44,165

WARRANTY COVERAGE

5-year or 60,000-mile Powertrain Limited Warranty.
 3-year or 36,000-mile Basic Limited Warranty.
 Ask Dealer for a copy of the limited warranties or see your owner's manual for details.

5 YEAR / 60000 MILE POWERTRAIN WARRANTY

SHPTD: 49326 36 SOLDTD: 47 49435
 FINDLAY CHRYSLER DODGE JEEP RAM
 100 STATE ROUTE 104
 STERLING HTS, OH 44084-1933
 TEL: 440-232-1000
 FAX: 440-232-1000
 OH 44040-1933

THIS LABEL IS ADDED TO THIS VEHICLE IN COMPLIANCE WITH FEDERAL LAW. THE LABEL CANNOT BE REMOVED.
 THIS VEHICLE IS SOLD AS IS. THE MANUFACTURER AND THE DEALER ARE NOT RESPONSIBLE FOR ANY STATE AND/OR LOCAL TAXES IF ANY, LICENSE AND TITLE FEES AND DEALER SUPPLIED AND MAINTAINED EQUIPMENT ARE NOT INCLUDED IN THIS PRICE. DISCOUNT, IF ANY, IS BASED ON PRICE OF OPTIONS, IF PURCHASED SEPARATELY.

For more information visit: www.ramtrucks.com
 or call 1-866-RAMINFO

FCA US LLC

EPA Fuel Economy and Environment

Fuel Economy These estimates reflect new EPA methods beginning with 2017 models.
17 MPG Standard pickups range from 14 to 22 MPG.
 The best vehicle rates 136 MPGe.

17	15	21
combined city/hwy	city	highway

5.9 gallons per 100 miles

You spend \$5,250 more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel Cost \$2,450

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

1	3	10
1	5	10

Smog Rating (tailpipe only)

This vehicle emits 523 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and using burning fuel also creates atmospheric carbon dioxide (CO₂) emissions. fueleconomy.gov

fueleconomy.gov
 Calculate personalized estimates and compare vehicles

GOVERNMENT 5-STAR SAFETY RATINGS

This vehicle has not been rated by the government for frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE:
 U.S./CANADIAN PARTS CONTENT: 57%
 MAJOR SOURCES OF FOREIGN PARTS

CONTENT:
MEXICO: 28%
NOTE: THIS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE:
 FINAL ASSEMBLY POINT:
 STERLING HTS, MICH., U.S.A.
 COUNTRY OF ORIGIN:
 ENGINE: MEXICO
 TRANSMISSION: UNITED STATES

VEHICLE PROTECTION
A PRODUCT OF FCA US LLC
 Ask for Mopar Vehicle Protection for your vehicle. We'll start it. We'll back it.

APPENDIX B
Discussion on Data

DISCUSSION ON DATA

Symbols for Brake Components

4-	4 Wheel	GG-	Groan	DL-L	Deceleration (State m/s ²)
X-	Skid	SSQ-Q	Squeal	PF-	Pedal on Floor
L-	Left	SSQK-	Squeakk -	SCP-	Shoe Scrape
R-	Right	PPO-	Pinchouthout	RB- O	Rubber Bandin
R-	Rear	P-	Pull	O-	Odor Odor
F-	Front	R-	Shudder	NOX-	No Skid
B-	Bothth	M-	Momentary		

INT or INIT	Initial Part of Stop
MID	Middleof Stop
END	End of Stop

All stops were made manually.

APPENDIX C

Contractor's Comments Procedure Modifications and Test Facility

Comments for vehicle Ram 1500.

For all recorded decelerations:

The recorded average deceleration values for the tests are slightly lower than which is required or targeted for certain sections. However, in all cases and in reality, the driver maintained the correct required/target deceleration values for the majority of time for each of those stops. The recorded deceleration is acquired from the moment the service brake pedal is moved until the vehicle reaches zero speed. Therefore, the time needed to achieve the target deceleration (rise time) and the time the vehicle goes from the target deceleration to zero (fall time) is included in the average deceleration values.

7.5-MILE TEST TRACK

The 7.5-mile test track encloses a 1,600-acre area, one mile wide and 3.5 miles long.

The track has a downward grade, north to south, of 0.228 percent and a cross slope in the straight-aways of 3/16 inch per foot. The 1.88 mile long straight-aways flow into transition areas 2,300 feet in length and then into 5,275-foot long curves with a constant radius of 2,400 feet. The 36-foot wide straight-aways and the 42-foot wide curves provide three test lanes. 12 foot berms border the straight-aways and the inside of the curves.

As a vehicle moves toward the outside of the track in the curves, it encounters a progressively steeper bank. The inside lane (or "slow" lane) has a bank of 10 degrees allowing a neutral speed of 80 mph with no side forces. In the center lane, the slope increases to 19 degrees resulting in a neutral speed of 110 mph. The outside lane's 28-degree bank allows a 140 mph neutral speed. Rimming the outer lane is a seven-foot safety lane culminating in a 36-degree slope at the guardrail.

The facility is paved with asphalt. It carries a maximum single axle load of 36,000 pounds and a maximum tandem axle load weight of 48,000 pounds. Special provisions can be made for heavier weight loads.

With 22.5 lane miles, our track will accommodate many vehicles simultaneously. Research which utilizes the track includes component performance and durability studies, brake tests, aerodynamic studies, fuel economy studies, drive line efficiency tests, and the determination of vehicular acceleration and cruise characteristics. In addition, it supports maximum speed determination, road load power, noise and emission measurements and tire durability test programs.

The 7.5-mile test track can be used in conjunction with other facilities at TRC. It provides an excellent area for pre-test conditioning of equipment such as brake burnishing, tire break-in, and vehicle warm-up.

TRC SKID PAD

The Skid Pad is a test facility which is utilized primarily for the evaluation of tire and brake systems.

The overall dimensions of the pad are 9,000 feet by 84 feet with loops on the north and south ends. Both turnaround loops have a 309-foot radius and are 16 feet wide with a 25 percent super elevation. They will accommodate speeds of 45 mph with zero side force and 60 mph with .5 g's lateral acceleration. The acceleration/deceleration lanes at each end are 3,280 feet in length.

A test area of 210,000 square feet is situated in the center of the skid pad containing several test pads with varying surface textures. Skid numbers in this area range from 30 (wet) to mid 80s (dry). Dry Peaks are in the upper 90's.

The skid pad is paved with Portland cement. The load capacity of the skid pad is 36,000 pounds maximum single axle weight and 48,000 pounds maximum tandem axle weight.